

ABET Best Practices: Results from Interviews with 27 Peer Institutions

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Abstract

ABET2000 criteria permit a variety of approaches to assessment. While this flexibility allows each institution the freedom to develop practices best suited to its particular circumstances, such flexibility can also create doubt whether the assessment practices employed will be found to be satisfactory by ABET evaluators. As the College of Engineering & Applied Science at CU-Boulder prepares for a fall 2005 ABET General Review of all of its programs, a number of peer institutions and knowledgeable experts were interviewed to gather information about “best practices” in the field of assessment and accreditation. This article summarizes data collected from telephone interviews with thirty-three individuals from twenty-seven institutions. Twenty questions asked respondents about their measurement methods for objectives and outcomes (advisory board input, alumni surveys, senior surveys, portfolios, FE exam, etc.), methods for engaging faculty and rewarding ABET coordinators, degree of college oversight, and methods for ensuring that a continuous improvement process is in place. The resulting data reflect a clear commitment to assessment and continual improvement on the part of virtually every respondent. Taken as a whole, these data provide a catalog of potential best practices. The data also reflect the difficulty in creating accurate and meaningful evaluation measures of highly subjective criteria.

Summary of Findings

This report summarizes the data collected from phone interviews with thirty-three individuals from twenty-seven institutions (see the Appendix). The primary purpose of conducting these interviews was to obtain information from peer institutions and knowledgeable experts about best practices in the field of assessment and accreditation. This was to support the college’s efforts in preparing for an ABET visit in the fall of 2005. A secondary purpose was to quickly familiarize the new Director of Academic Programs and Assessment with current trends in assessment and accreditation.

Although no attempt was made to specifically include any identifiably "general" or "multidisciplinary" engineering programs in the interviewing sample (this was not a focus of this particular study), it is likely that many of the responses would be similar for these programs. The majority of the respondents replied for departments that were discipline specific (e.g.,

Electrical Engineering, Mechanical Engineering, Civil Engineering, Chemical Engineering, Architectural Engineering, etc.), although some respondents replied for their entire college, which included several different disciplines.

While it might be expected that responses would be similar, it is not possible to draw conclusions from this survey for any but large, state-supported research institutions, as this type of institution comprised most of the sample and was more typically identified as a peer institution to the authors' college. Other types of institutions, e.g., private research universities and/or smaller private schools that stress undergraduate programs and feature general education might respond quite differently to some of these questions.

To some extent, all of the data collected represent “current practices” more than “best practices”, as respondents from nearly every institution acknowledged that they were still seeking answers to several questions themselves. All expressed an interest in seeing the results of this survey, presumably because knowing what others are doing would at least provide the comfort of knowing that you were practicing in the range of current practice.

Some comfort can also be drawn from the fact that of the twenty-seven institutions participating in the survey, sixteen reported that they were extremely successful (all programs at the institution received Next General Review – NGR) or very successful (nearly all programs at the institution received NGR) with respect to ABET accreditation. The respondents must know something about accreditation, or their institutions would not have been as successful as they have been.

When specifically asked to cite their best practices, the two most commonly cited practices were:

- a) Ensuring that a continuous improvement process is in place and that changes have been made as a result of assessment efforts; and
- b) Establishing an ABET committee with representation from each department or program for the purpose of coordinating and sharing best practices.

Neither of these practices is particularly surprising. The first reiterates the fact that assessment requires a feedback loop to guide changes and measure results. The second acknowledges that sometimes the best sources of “best practices” are to be found within the departments and programs of your own college or school. Several other best practices are mentioned in the report which follows.

While most of the respondents indicated that their institution did not require a consistent approach to accreditation, and allow programs to develop their own specific assessment tools and practices, most institutions do have their college/school serve in a coordinating role. In addition, the college coordinates or administers various surveys, including alumni, senior and/or employer surveys; completes the ABET Appendix II document; and gathers the assessment information for core courses and general education courses such as math, physics, chemistry, writing, etc.

While the distinction between outcomes and objectives continues to baffle some, most understand outcomes to be what the student should be capable of doing at the time of graduation, and objectives to be what the student should be capable of accomplishing several years after graduation. The most successful measures mentioned for objectives were advisory board input and alumni surveys. The most successful measure for outcomes was course work assessments

(from embedded questions to senior design projects), complemented by data gathered through senior surveys.

Measurement of the softer criteria (team work, communications, life-long learning, ethics, etc.) has nearly everyone concerned, as these criteria do not as readily lend themselves to measurement and because they are subjects that are taught in multiple places in the curriculum, sometimes outside of the direct control of the college.

Use of FE exam data is spotty, used primarily in civil and mechanical engineering programs. Portfolios are not widely used, deemed by most to be unmanageable due to the large volume of data that must be collected and the possible turnover of students. Those programs using portfolios tend either to be small, or in fields where having students collect work made sense for the student's future employment opportunities (e.g., graphic arts and architecture).

Nearly every institution conducts senior and alumni surveys. There appears to be a move in the direction of web-based surveying. Response rates continue to be problematic, particularly for the alumni surveys. This is less true for the seniors, where the completion of the survey can be made a requirement of a course or graduation. Although surveys are still deemed to be useful sources of information, many respondents noted that these are secondary sources and cannot be used in place of primary sources such as course work.

Advisory Boards are used in a variety of ways, but primarily to validate that the program has the right objectives and, sometimes, outcomes. Advisory Boards are also used to provide feedback on existing curriculum and proposed curriculum changes, and to review assessment data. Interviewing students, and participating in some fashion with senior design projects was also mentioned.

Ensuring that a continuous improvement process and feedback loop are place, and that changes have been made as a result of the assessment, were deemed essential by most respondents, who appear to believe that ABET will focus more on this in the future. The curriculum or undergraduate education committee, the ABET coordinator, or the assessment committee are most frequently cited as the party responsible for evaluating the data and deciding which actions to take. A third of the respondents indicate that their Dean requires an annual (or periodic) report, or an annual log indicating actions taken in response to lessons learned.

While many different techniques are used for engaging faculty (faculty meetings, retreats, email, etc.), leadership from the top was most frequently cited as the means by which faculty can be engaged. If the leaders clearly value assessment, faculty will follow their lead. In addition, faculty are often required to be involved to a certain extent, as they provide input to objectives and outcomes and must provide course descriptions, syllabi, vitae, materials for student portfolios, etc. in preparation for ABET visits.

All respondents indicated that they assign ABET coordinators for each program, and most reward these coordinators in some tangible fashion (course forgiveness, summer pay, staff support, etc.). Many ABET coordinators perform this task as a part of another assignment for which they receive compensation (Department Chair, Associate Chair, etc.).

A few institutions are starting to make the connection between ABET and the body that accredits the institution at the campus level (e.g., North Central, SACS, etc.). Some use ABET data for the other accrediting body, and vice versa. There is a growing recognition that the other accrediting bodies are moving in the same direction as ABET in terms of outcome assessment; this may allow for more common use of data in the future. That said, different management structures, reporting periods, scope of reviews, etc., will continue to make building linkages between these accrediting bodies problematic.

Details on interesting articles, worthwhile conferences and experts in the field can be found in the information below. Standing out above others are the Rose-Hulman Conference (Gloria Rogers), ASEE, and ABET sponsored workshops and conferences.

Woven throughout the interviews could be found a dichotomy of opinion – with both opinions sometimes shared by the same person! There is a clear commitment to assessment and continual improvement on the part of virtually every respondent, at the same time that there is a concern about the level of work required to demonstrate to ABET that an adequate continuous improvement process is in place. In fact, most criticisms of ABET were related to whether the program evaluators and team chair would be fair in their evaluations and willing to acknowledge the difficulty of accurately measuring criteria for which hard measurements cannot be found.

ABET is attempting to practice continuous improvement. They have commissioned a study through Penn State that will assess if students are learning the skills necessary and acquiring the knowledge consistent with ABET 2000 criteria. The final Penn State report will be published in the summer of 2005 and information can be found at their website:

<http://www.ed.psu.edu/cshe/abet/ec2000.html>.

Methodology

In preparation for an upcoming ABET visit in the fall of 2005, our college deemed it advisable to obtain as much information as possible about best practices with respect to assessment and accreditation. This task was undertaken by the Director of Academic Programs and Assessment (hereafter referred to as “Director”), whose responsibilities include coordinating the college’s ABET effort.

The decision to survey particular institutions and individuals was driven by two factors:

- a) Whether the institution was deemed to be a peer institution by our College’s Dean, Department Chairs or ABET coordinators; or
- b) Whether the individual was suggested as someone who could provide substantive insights – usually an ABET insider (officer, team chair, frequent evaluator).

A total of thirty-three individuals from twenty-seven institutions were interviewed.

In those cases where an individual was suggested, that person was contacted directly. In those cases where an institution was suggested, it was necessary to determine which individual to contact. If the institution was suggested as a peer institution by only one program (e.g., the University of Nebraska), the person interviewed was generally the individual overseeing the

ABET effort for that particular program. If the institution was suggested by multiple programs as a peer institution (e.g., University of Texas – Austin), the person interviewed was an individual familiar with the overall ABET effort across the college. In a few instances (e.g., Purdue University), both the person responsible for a particular program and the individual with broader insights across the entire institution were interviewed.

Several of the people with whom the Director spoke were involved in some fashion in ABET, including:

- a) Bill Kelley, former ABET EAC Chair;
- b) Dick Seagrave, Secretary of the ABET board and President Elect (our discussion was brief, as he referred the Director to a colleague at Iowa State for the full interview);
- c) Gordon Geiger, formerly President of ABET;
- d) Daina Briedis, Member-at-Large of EAC board;
- e) Robert Warrington, Member-at-Large of EAC board;
- f) John Weese, on ABET board; as well as
- g) faculty who serve as Team Chairs or Program Evaluators.

An initial list of fourteen survey questions was developed by the Director. The ABET coordinators and Dean of Education provided feedback and suggested additional questions which led to a final list of twenty questions. The goal was to have no more than twenty questions so as to reduce the burden on the individuals being interviewed.

Interviewing by phone was selected as the preferred means to obtain information, since it would allow for probing for additional information and would also allow the Director to make contacts and build relationships within the community of college of engineering assessment specialists. Interview lengths varied from 20 minutes to an hour. The difference in length was primarily a result of the verbosity of the respondent. Most interviews lasted about 40 minutes, with most respondents being very generous with their time and knowledge. The authors gratefully acknowledge this generosity.

The Director was persistent in making the necessary contacts, and all selected individuals and institutions were reached and agreed to participate in the interview. The Director promised to share outcomes with all participants, which may have been part of the reason for the respondents' willingness to participate. Nearly every respondent indicated that they could benefit from knowing more about what other institutions were doing with respect to ABET. The Director was also impressed by the extraordinary candor and insights offered by the respondents, all of whom seemed genuinely concerned about assessment.

The following caveats are noted with respect to results obtained:

- 1) Not every question was asked in every interview. While the goal was to do so, in a couple of cases, the interview was cut short by the interviewee.
- 2) While most interviews followed the original order of the questions, the natural flow of the conversation sometimes dictated moving ahead 4 questions and then back to where the conversation left off. While this probably did not affect the veracity of the answers, it may have led to a slightly different perceptual framework in the mind of the interviewee.

- 3) As the interviewing process progressed, it became obvious that some additional questions would be helpful. These questions were not asked during the first few interviews that were conducted and did not always come up in subsequent interviews (e.g., in the question related to senior survey, additional questions such as “How were your senior surveys administered?” and “Were they web-based?” came up in later interviews). Therefore, conclusions that range beyond the original survey questions might be underreported. For example, seven respondents reported using web-based senior surveys, but the number might actually be higher, as this was not posed as a specific question until later in the interviewing process.
- 4) While summarizing the data, there were cases where something mentioned in response to one question fit better in the data being accumulated for another question. In that case, the response was placed where it made the most sense. For instance, one respondent mentioned their annual assessment process in response to Question 16 about ABET coordinators, but failed to mention this process in Question 14 regarding feedback loops.
- 5) Some responses covered more than one of the tallied responses. In this case, both were counted. For instance, in the senior survey question, a respondent indicated that they use a web-based senior survey administered as an assignment in a senior seminar or projects course. This would count both in the ‘web-based survey’ response and in the ‘survey was a required assignment in senior seminar’ response. Hence the responses cannot be summed to the total number of respondents.

The Director committed to respondents that their feedback would be kept anonymous. Therefore, attribution of specific statements is only provided in this paper when advance permission was obtained from the respondent.

Detailed Findings by Question

While the Summary of Findings provides a general perspective on the results of the interviews, this section will cover the results by individual question. The actual responses received can be found online at <http://ecadw.colorado.edu/engineering/ABETBestPractices.htm>.

Q. 1 Conducting a Successful ABET Review – Best Practices

The two best practices mentioned most frequently (by nearly a third of the respondents) were:

- a) Ensuring that a continuous improvement process is in place and that changes have been made as a result of the assessment; and
- b) Establishing an ABET committee with representation from each department or program for the purpose of coordinating and sharing best practices.

With respect to demonstrating a continuous improvement process, several individuals commented that they felt this was likely to be as important, or even more important, than the actual data collected. One individual summarized this view as follows:

“ABET is now all about improvement rather than the existing quality of the program. The result is that you can get a glowing review if you can show improvement, even if you are a mediocre program to begin with. Whereas if you are a fantastic program, but can’t demonstrate improvement, you can receive a

poor review from ABET. But it is difficult to quantify and prove that you are doing what you are supposed to do. So ABET accreditation doesn't necessarily mean your program is any good, just that you are getting better and have figured out how to demonstrate that."

Several respondents who had been through one visit using the EC2000 criteria, and were coming up on a second visit, voiced a concern that the feedback loop would be more closely scrutinized by ABET in the future. Responses to Question 14, which addresses the question of demonstrating a feedback loop is in place, also indicated concerns on the part of several individuals that this would be difficult to prove.

While only eight respondents mentioned an ABET committee as a best practice, seventeen respondents indicated that they had such a committee in response to Question 2 regarding the role of the college. Even in those institutions in which programs were encouraged to pursue accreditation in their own way, the value of some coordination and sharing of information between programs was generally recognized.

Other best practices seemed to fall into three primary categories:

- a) Ongoing assessment practices
- b) Preparation for the ABET visit
- c) Conducting and follow up from the visit

Best practices for ongoing assessment include: establish clearly stated goals and objectives; know what you want to measure before starting to measure it; collect minimal information for maximum results (be sure what you put in place is sustainable); use multiple assessment tools, including several primary measures (not just secondary measures such as surveys); require an annual review/report of assessment progress; and encourage faculty to become ABET evaluators.

Best practices with respect to ABET visit preparation included: start early, get faculty buy-in, know past shortcomings and be prepared to address them; develop good documentation and a solid self-study; critique each others' work (mock reviews were suggested by several); provide a good mapping between ABET outcome criteria and your own outcomes; and use a flowchart to show your entire assessment process graphically. A few schools mentioned that they were now organizing course material by outcome criteria rather than by course to make it easier for reviewers to verify that all outcomes are being covered somewhere in the curriculum.

Best practices with respect to the visit itself included: make it simple for reviewers to find everything they need; and make a good first impression.

Several other best practices were reported by a single institution. These practices are shown online at <http://ecadw.colorado.edu/engineering/ABETBestPractices.htm>

Q. 2 Accreditation Success

Because this information was self-reported, and was therefore filtered through the perceptual bias of the respondent, it was difficult to be certain of the precision of the responses. That is, one

respondent's "reasonably successful" might be another respondent's "very successful". For that reason, respondents were asked to be as specific as possible with respect to the exact numbers of programs receiving a next general review, interim visit, interim report, etc. Then the responses were categorized into five categories.

Sixteen of the twenty-seven institutions reported that they were extremely successful (all programs received Next General Review – NGR) or very successful (nearly all programs received NGR). Two reported that they were reasonably successful (a number of programs receiving a NGR). Three reported a mixed review (some programs received NGR; others received interim reports or visits). Only one reported that they had not been very successful (multiple interim reports and visits, few NGR). Four respondents said they were coming up on their first review with EC2000 criteria and therefore, were uncertain as to how they would fare. Only one respondent declined to be specific in answering this question.

Six respondents mentioned that part of what determined a program's success was who was chosen as the program evaluator. This is apparently recognized as an issue by ABET. In their 2003 Annual Report¹, ABET mentions that "consistency of evaluations" was one of the several major areas of concern mentioned by their constituents. Also from the 2003 Annual Report¹, "The Participation Project is essentially a complete overhaul of ABET's recruitment, training, and performance evaluation guidelines and processes for all individuals involved in accreditation activities on behalf of ABET." Consistency is also mentioned as an issue in the EAC portion of the 2003 Annual Report² which states that "Activities were undertaken to address training of evaluators, consistency issues, feedback on program evaluators and team chairs...."

Q. 3 Role of the College in Accreditation

When asked about the role of the college in the assessment and accreditation process, the four most commonly cited roles were:

- a) Coordinating a team of ABET coordinators which shared best practices (17 respondents);
- b) Coordinating and/or administering various surveys, including alumni, senior and/or employer surveys (15 respondents);
- c) Completing the Appendix II document (10 respondents); and
- d) Gathering the support information and/or assessing core courses and general education courses such as math, physics, chemistry, writing, etc. (6 respondents).

Eight respondents indicated that the programs have to be the primary responsible parties because it is the programs that are being accredited, not the college.

Respondents were not prompted, so some may have neglected to mention all responsibilities assumed at the college level. For instance, Appendix II is typically compiled at the college level, yet this practice was mentioned by only 10 respondents.

Other responses that were mentioned by one or two respondents fell into six categories:

- a) Determining what was needed for assessment;
- b) Enforcing deadlines and standards (e.g., common templates);
- c) Performing quality control (e.g., reviewing all self-studies);

- d) Coordinating with other organizations to obtain/evaluate data (e.g., Career Services, centralized campus assessment office);
- e) Investigating possible assessment tools; and
- f) Coordinating/organizing/helping programs get ready.

Q. 4 Consistent Approach to Accreditation

When asked if they employed a consistent approach to accreditation across their programs, twenty respondents indicated that they did not – that departments and programs were free to do whatever they wanted to do. Many made the comment that the programs were in the best position to judge what was needed and that consistency would not be welcomed. However, most who made this comment also mentioned that they still sought to share best practices. Apparently, knowing what everyone else is doing is a good thing – even if decision makers in each program act independently and decide what is best for their own assessment and accreditation efforts.

Only four respondents said they employed a consistent approach across programs, but three of these allow for some customization within the programs.

Common elements which were specifically mentioned included: a common template for the self-studies, a consistent vocabulary and a common philosophy.

Q. 5 Defining “Outcomes” vs. “Objectives”

While it seems that information recently published by ABET is beginning to clear up the confusion with respect to the difference between outcomes and objectives, there still appears to be some confusion regarding this difference.

A third of the respondents understood outcomes to be what the students can do at graduation and objectives to be what graduates can accomplish several years later. But there were also variations on this theme, including: short term (outcomes) vs. long term (objectives); low level (outcomes) vs. high level (objectives); measurable (outcomes) vs. unmeasurable (objectives); campus based (outcomes) vs. practice based (objectives); and defined by industry/professional societies (outcomes) vs. defined by programs (objectives).

One interesting answer was that “outcomes are what we expect the student to learn, while objectives are what the faculty wants to teach.” Another interesting spin was that objectives tell a recruiter whether they could use your students in their organization, while outcomes would be what the recruiter would use to assess your students’ skills.

Several respondents expressed ongoing confusion on this issue; one expressed that their definitions don’t match ABET’s definition any longer (given ABET’s recent clarifications on this subject), but they are sticking with their definitions because they have been using them for several years. Another respondent expressed concern that ABET would ask academic institutions to somehow guarantee what the students would accomplish down the road,

maintaining that this was not their role or responsibility, and the most that they could measure is potential, not what the student actually may have accomplished.

Q. 6 Successful Measures for Criterion 2 – Objectives

The top two measures being used for objectives are advisory board input and alumni surveys (two-thirds of the respondents mentioned these). Advisory boards are used as sounding boards to provide feedback on whether the program has the right objectives. Alumni are also asked to evaluate the objectives and, in some cases, to indicate whether they believe that they have individually met these objectives.

Nearly a third of the respondents mentioned employer or industry surveys. Most said that it was difficult to obtain good information from industry, partially because no single individual within a large organization can evaluate all of the employees who graduated from a particular institution and program, and partially because of a reluctance on the part of employers to share what is either perceived to be personnel information (and hence, confidential) or subjective (how well one institution's graduates compare to another's). The few that believed that employer surveys were worthwhile attributed their success to their well-established relationship with the employers, many of whom serve on their advisory boards.

A few schools mentioned that they seek information either directly from alumni, or from their career services organizations related to job placement or graduate school acceptances.

Four respondents mentioned that they do not measure their objectives directly, but map their department/program outcomes to their department/program objectives. In these cases, if the students and/or alumni have met the outcomes, they are deemed to have also met the objectives. This practice was validated by a review of the alumni surveys provided by several respondents. Many of these surveys ask alumni to evaluate their competency with respect to ABET outcomes, not objectives.

Other practices that were shared include: “make sure you define your constituents and gather input from them”; “make sure your objectives are listed in the catalog and on your website”; “assess your objectives less frequently (every few years)”; and “choose your objectives so they are in line with the strength of your program.”

Q. 7 Successful Measures for Criterion 3 – Outcomes

The top two measures being used for outcomes are examples of students' course work (carefully displayed and collected at strategic points during their studies), and embedded course-based measures such as online simulations, test questions, lab reports, etc. Related to this but mentioned less frequently were two other measures: capstone/senior design courses/projects, and portfolios. Portfolios are addressed in more detail in response to Question 10. Several respondents mentioned a trend toward using rubrics in evaluation – a clear definition of what is being measured along with well-defined criteria that define various levels of accomplishment.

Several respondents mentioned that they were also using senior surveys, other surveys with students (e.g., junior, mid-curriculum, and freshman), or face-to-face interviews with students, to measure outcomes. However, most acknowledged that it was essential to use primary evidence (e.g., course work), and not just secondary evidence (surveys), to demonstrate that outcomes are being achieved.

Other measurements in use included: FE exam data (more on this issue in response to Question 9), feedback from instructors (both on what outcomes their courses are designed to cover and how well prepared their students were with respect to these outcomes), advisory board input, employer surveys, GRE exam results, admission to graduate school, job placement information and even grades. The two that mentioned grades acknowledge that ABET does not necessarily support the use of grades as a measure of outcome success.

The distinction between outcomes and objectives often came up in conjunction with this question, and several respondents mentioned that life-long learning would be easier to measure as an objective, after graduates have been in the working world for awhile, than as an outcome, while the student are still in school. It is simply too soon to know whether they will become life-long learners until they have a chance to demonstrate it.

Apparently, the Foundation Coalition has put together ‘mini-docs’ for Criteria 3a-k, describing some best practices for measuring these criteria (per Susan Haag, Arizona State University). These documents provide instructional approaches and assessment information for various criteria, and are particularly focused on the softer criteria related to teaming, global and societal understanding, life-long learning, ethics, etc. Interested parties may find this information on the assessment portion of the Foundation Coalition website at: <http://www.foundationcoalition.org/>

Q. 8 Measurement of “Softer” Criteria

When asked about measurement of the “softer” criteria such as ethics, teamwork, life-long learning, global and societal understanding, etc., the most commonly mentioned measures were related to either course work (from capstone senior design projects, introduction to engineering courses, general education courses, etc.) or surveys of students and/or alumni. Some institutions ask their students/alumni if they received sufficient exposure to these topics, while some asked students if they understood these topics.

One interesting approach is to combine multiple requirements in a single project. The senior design project is one example of this approach; other approaches mentioned were having students practice their verbal communication skills while reporting about ethics; using community service projects to practice teaming, societal responsibility and communication skills; and exposing students to topics in seminar courses, and then having them practice their written communication skills in a report about the speaker’s presentation.

There was less agreement among respondents on this question than on most other questions. A few pointed out that it is important to define what is meant by each of these criteria in the context of a specific program, i.e., to decide where in the curriculum these topics will be taught and then thoughtfully develop appropriate measures. A few respondents mentioned that this was their

weakest area and that they had little to show in the way of hard results. Nearly everyone expressed some uncertainty as to what would be deemed an acceptable measure by ABET.

With respect to life-long learning, many different measures are in use, most of which rely on self-reporting by the student. These include:

- a) Use of internet or library for self-directed learning;
- b) Additional degrees or certifications;
- c) Additional classes (e.g., continuing education) or in-house training;
- d) Subscriptions to newspapers, journals or magazines;
- e) Memberships in professional organizations;
- f) Participation in research/publication;
- g) Attending conferences; and
- h) Tutoring students.

One institution requires that students develop a life-long learning plan as an assignment in their undergraduate engineering seminar class. These plans are then evaluated by faculty.

Ethics was specifically mentioned by a few respondents, two of whom mentioned that they had a required course in ethics in their engineering curriculum. One of these courses is co-taught between engineering and the institution's Department of Philosophy. One other institution mentioned that it holds a summer ethics workshop for faculty to teach them how to incorporate ethics into their course curriculum. Faculty receive one week of pay to attend and must demonstrate that they have used what they learned in the workshop to incorporate an ethics component into their class(es). This approach has apparently been successful, since one-third of their faculty members have attended.

Q. 9 FE Exam Requirements and Compensation

Only two institutions mentioned a requirement for students to take the FE exam; these students are not compensated. All other respondents indicated that the FE exam is not required, although many encouraged their students to take it. Only two mentioned that they compensate students for taking the FE exam, while one respondent indicated that if finances were an issue for the student, the fee would certainly be covered.

Several mentioned that their institution offered either information sessions, review sessions or practice tests to help prepare students for the FE exam. Three respondents mentioned that obtaining PE certification was a sufficient inducement for most civil engineering students to take the exam. The two most frequently cited programs for which the FE exam was deemed important were civil engineering and mechanical engineering.

Q. 10 Portfolio Usage

Seventeen respondents indicated that they did not use portfolios, although two of these respondents indicated that they had started to do so but found the practice too burdensome. The primary reason cited for not using portfolios was the difficulty in managing them and analyzing the data collected. Only three respondents indicated that they use portfolios in all of their programs.

A few respondents indicated that certain of their programs used portfolios. Generally these were smaller programs where data collection would be less of an issue, or they were programs in which it would make sense for students to keep a record of their work (e.g., computer or graphic art, architecture, etc.). Some portfolios are collected by the student, some by the faculty.

Q. 11 Senior Surveys

All but one respondent indicated that they use senior surveys of one type or another. The one program that indicated they did not use senior surveys said they rely on interviewing a random sample of their graduating seniors, because the response rate to the surveys was so low.

There was wide variation in the way in which senior surveys are administered. Some used web-based surveys; some used paper surveys. Some require students to complete the survey as part of a course requirement (e.g., in senior seminar or senior capstone); some gather the data in class. Others capture this information from students just prior to graduation in conjunction with some well-defined event such as a degree audit or picking up their caps and gowns. Some are voluntary; some are required. No conclusions with respect to response rate to senior surveys can be made, since response rate was not specifically sought in conjunction with this question. A few respondents indicated that students received some sort of incentive for completing the survey, such as school memorabilia or graduation invitations.

A few respondents mentioned that they use Educational Benchmark, Inc. (EBI) surveys, but for every respondent that was delighted with the use of this service, there was another that was no longer using EBI due to a perception that they could capture better data on their own. The most frequently mentioned benefit of using EBI surveys was the ability to compare the institution against those peer institutions which also use EBI surveys.

Q. 12 Alumni Surveys

All but one respondent indicated that they use alumni surveys; the one respondent who said they did not indicated that they planned to do so in the future when they had more graduates (this was a relatively new program). Many indicated that they were moving towards web-based surveys, although some still sent postcards directing alumni to the website, or sent paper surveys.

Again, there was a wide variety of approaches to conducting the alumni survey. Most respondents agreed that respondents should be chosen from within a five year window of their graduation date. When more than five years has elapsed since their graduation, the alumni can no longer recall as many specifics about the program and their work experience begins to account for more of their knowledge level than their education.

Response rates cited ranged from 10% to 60%, with most falling in the range of 10-30%. Very few institutions used inducements in an attempt to secure a better response rate. Those that did use an inducement mentioned both intangible and tangible inducements. Intangible inducements included such things as stressing the importance of the survey to the institution and the value of their degree, or using a favorite faculty member to make the plea for a response. Tangible

inducements included a drawing for football tickets, paying for postage and sending a ‘crisp one dollar bill’.

Five respondents mentioned that their alumni surveys are handled at the campus level; two respondents mentioned the use of EBI surveys, and one mentioned that they gathered their alumni data primarily from their alumni advisory board.

Q. 13 Departmental Advisory Boards

The most commonly mentioned use of departmental advisory boards in the ABET process was related to the review of program objectives (19 respondents). This was confirmed by the response received to Question 6 (most successful measures for Criterion 2 – objectives).

Other frequently cited uses for advisory boards with respect to ABET included providing feedback on outcomes (Criterion 3), providing feedback on existing curriculum and proposed curriculum changes, reviewing assessment data, meeting with students in small groups to gather data about the program, and participating in some manner with the senior design projects/presentations.

Two institutions ask their advisory boards to provide feedback on their self-study reports; two institutions require their advisory board to generate a report about their findings that goes to the Department Chair and Dean.

Several respondents mentioned somewhere during the course of the interview that input from constituents such as advisory boards had to be taken with a grain of salt. The information received was sometimes too global to be helpful, or was not in line with current commonly accepted approaches to pedagogy.

Q. 14 Feedback Loops and Continual Improvement

Ensuring that a continuous improvement process and feedback loop are in place and that changes have been made as a result of the assessment was one of the top two best practices cited at the inception of this report. Not surprisingly, half of the respondents indicated that they have incorporated feedback loops into their curriculum or undergraduate education committee, where minutes are recorded and actions are taken to respond to identified problems. One third of the respondents said that their ABET coordinator or assessment committee is responsible for evaluating the data and deciding which actions to take. One third of the respondents require an annual (or periodic) report which includes an assessment component or an annual log. This provides a centralized archive of actions taken in response to data collected.

Other places where the use of a feedback loop can be demonstrated is through discussions with departmental advisory boards, faculty (such as at faculty retreats), or college-wide advisory boards (such as undergraduate education council or undergraduate studies committee).

In spite of efforts taken to ensure that feedback loops are in place, several respondents expressed concern that this was a weak area for them or that it was too difficult to ensure that all of the

feedback loops were working properly. It was also anticipated that this will be more of a focus for ABET visitors in the future than it has been in the past, and that anecdotal evidence will no longer be deemed sufficient.

Q. 15 Engaging Faculty in Assessment and Accreditation

The most frequently mentioned means by which to engage faculty in assessment and accreditation was leadership from the top. The Deans, Associate and Assistant Deans must all provide top-down direction and support. If the faculty perceive that the college only does the minimum required to pass its accreditation review, there will not be a sustained focus on assessment in-between ABET reviews. Department chairs, assessment committees and ABET coordinators are other key participants who can help to engage the faculty.

While a few mentioned engaging faculty at faculty meetings, it was generally acknowledged that these are not always well attended. Faculty retreats were also mentioned as a place to engage faculty, as were training sessions and workshops.

A few mentioned providing faculty with some form of written information about ABET, and two mentioned that they relied on the repetition method: tell them what you are going to tell them; tell them; tell them what you told them.

Others noted that faculty are required to be involved to a certain extent, as they provide input to objectives and outcomes and must provide course descriptions, syllabi, vitae, and materials for student portfolios in preparation for ABET visits.

Some of the more creative methods mentioned for engaging faculty included:

- a) Win the faculty over by showing that you are addressing problem areas in the curriculum (e.g., students who are not well prepared in math);
- b) Help faculty by providing them with background information they need for their grant proposals and explain how this data was obtained in the assessment process;
- c) Excite the faculty by introducing innovation into the curriculum; and
- d) Playfully engage them, such as giving edible rewards to faculty who complete their assessment information on time.

On the more pessimistic side: one respondent noted that it was difficult to maintain momentum between visits; one noted that they pointed to past failures to demonstrate how bad things could be if assessment processes were not conducted properly; and one respondent said they do not seek to involve faculty who are not interested (but rather seek to minimize their involvement and allow them to stay focused on their primary job of research and teaching). One respondent summed it up this way, "Everyone understands the importance, but nobody wants to do anything about it."

A few respondents mentioned that their faculty was not entirely supportive of ABET. The primary concerns which were expressed related to:

- a) The arbitrariness of reviewers;

- b) ABET is perceived as being run by non-research intensive institutions and the ABET leaders do not understand the environment in a research intensive institution;
- c) ABET takes control away from faculty who are in the best position to judge what should be taught; and
- d) Some faculty members do not teach ABET evaluated courses and therefore feel less engaged.

Q. 16 ABET Coordinators

Every respondent indicated that they have ABET Coordinators, and most used the name “ABET Coordinator”. Compensation for the coordinators varied widely, even within an institution, as it was generally left up to the program or department to decide upon an appropriate award.

The most frequent rewards cited included (in descending order of frequency of mention):

- a) Included in compensation received for larger role (such as department chair, associate chair or head of undergraduate curriculum committee);
- b) Course relief or course forgiveness;
- c) Goodwill, appreciation or lunch;
- d) Summer pay; and
- e) Additional administrative or staff support.

Four respondents said there was no compensation; two indicated they were not sure if there was any compensation.

Two mentioned that being assigned as an ABET coordinator may be in lieu of bringing in research grants; one suggested that older faculty member whose research is winding down might be the best ones to assign; and one suggested that using tenured faculty was better, since they would not be so concerned about their ABET efforts detracting from their participation in research and teaching – two key components evaluated in tenure decisions.

Q. 17 Linkages between ABET and Other Accrediting Bodies

Over one-third of the respondents interviewed (11) are from institutions that are accredited by North Central (the authors’ institution is also North Central accredited). Five of these have no linkages between the two accreditation processes – they operate in parallel, but separately. Four have used some ABET information for their North Central review and two have used some North Central information for their ABET review.

Six of the respondents were from institutions that are accredited by Southern Association of Colleges and Schools (SACS). Three of these indicated that they seek to make linkages between the two wherever possible, using common data for both. Two mentioned that SACS is becoming more focused on outcome assessment so that this will provide the opportunity for more linkages in the future. One mentioned SACS, but did not provide information regarding whether any linkages existed.

Three of the respondents were from institutions that are accredited by Middle States: one noted no connection; one used Middle States information for ABET review; one mentioned that there was currently no linkage, but that Middle States is becoming more focused on assessment than they have been.

The remaining respondents were accredited by Western Association of Schools and Colleges, Northwest Association of Schools and Colleges or the Accreditation of Western Universities (This last one is probably the Western Association of Schools and Colleges).

An overall theme that emerged in response to this question is that, while many linkages do not exist at the current time between the two types of accreditation (ABET and North Central/SACS/Middle States, etc.), more linkages are likely in the future, as outcomes assessment becomes more of a focus for all of these organizations.

Q. 18 Articles Worth Reading

When asked about articles that are worth reading related to ABET best practices and assessment, the following articles received more than one citation by respondents:

- a) Articles by Gloria Rogers (Rose-Hulman) (4 responses);
- b) Journal of Engineering Education (4 responses);
- c) NSF website and their sponsored coalitions (Foundation, Succeed, Greenfield, etc.) (3 responses);
- d) ABET published material such as Criteria for Accrediting Engineering Programs and Accreditation Policies and Procedures Manual or other information on their website (3 responses);
- e) Articles by Daina Briedis (Michigan State) (2 responses);
- f) Articles or book by Trudy Banta (IUPUI) Building a Scholarship of Assessment (2 responses); and
- g) Rose-Hulman best practices documents/proceedings (2 responses).

Q. 19 Conferences Worth Attending

When asked about conferences that are worth attending related to ABET best practices and assessment, the following received more than one citation by respondents:

- a) Rose-Hulman conference (13 responses);
- b) ASEE conference and workshops (10 responses);
- c) ABET annual conference in October (9 responses);
- d) ABET Dean's Day in July before review (5 responses);
- e) ABET workshops (4 responses);
- f) FIE (Frontiers in Education) conference (4 responses);
- g) ABET Program Evaluator training (3 responses);
- h) AAHE conference (2 responses); and
- i) Professional society workshops (e.g., NEEDHA, now ECEDHA) (2 responses).

Q. 20 Experts in the Field of Assessment and Accreditation

When asked about experts in the field of assessment and accreditation, the following received more than one citation by respondents (those interviewed in conjunction with this survey are noted in bold face type):

- a) Gloria Rogers, Rose-Hulman (7 responses);
- b) Barbara Olds, Colorado School of Mines (in Washington DC at time of study) (4 responses);
- c) **Ron Miller**, Colorado School of Mines (2 responses);
- d) Trudy Banta, IUPUI (2 responses);
- e) **Daina Breidis**, Michigan State (2 responses);
- f) Eleanor Nault, Clemson (2 responses);
- g) **Dick Seagrave**, Iowa State (2 responses);
- h) People at ABET (various people mentioned including Kate Aberle, Ellen Stokes, Dan Hodge, Bob Herricks) (2 responses);
- i) Ira Jacobson, formerly at Embry-Riddle, former officer of EAC (2 responses); and
- j) **Joseph Hoey**, Georgia Tech (2 responses).

While it was tempting to contact each of these knowledgeable individuals to seek their participation in this survey, this did not seem advisable for four main reasons:

- a) Some of these individuals were from institutions where someone had already been interviewed (e.g., Ron Miller at the Colorado School of Mines had been interviewed, so interviewing Barbara Olds would likely provide overlapping information);
- b) Some of these individuals were from institutions that were not mentioned as a peer institution and had not been specifically recommended for interviewing by the Dean, Department Chairs or ABET Coordinators;
- c) Including more “experts” in the sample might have the effect of distorting the results; and
- d) Where would it all stop? More respondents would mention more people and there would always be more to interview!

Q. 21 Other Thoughts

Many respondents offered comments not directly related to a specific question. These comments can be found online at <http://ecadw.colorado.edu/engineering/ABETBestPractices.htm>.

Conclusions

Conducting this best practices review was truly an eye-opening experience. Perhaps the biggest surprise was that virtually everyone was readily willing to share their own concerns and doubts about assessment and the accreditation process.

One disturbing comment, offered by three different individuals, was that any staff person involved in accreditation (this Director included), is unlikely to be taken seriously or deemed credible because they are not a member of the faculty. Hopefully, this will prove untrue, as the Director works side by side with faculty to develop a common senior and alumni survey, course

proposal documentation with an ABET component and a number of other helpful tools and techniques for assessing our college's progress towards excellence in education.

While several respondents mentioned the positive aspects of ABET, Neal Armstrong from UT-Austin summed them up very well as follows (thanks to Neal for permitting attribution of this statement):

- a) "ABET forces us to look at our curriculum more critically. This is a good thing! It is also helpful for faculty to understand that the development of curriculum is something that follows a consideration of what the objectives of the program are and what you expect the graduates to be able to do when they finish the program. This approach makes curriculum review a much more meaningful exercise.
- b) Because new criteria are "outcome based" and focus on what students can do when they graduate, we can take advantage of that student focus. Help faculty to focus more on what the students are learning, not just what they are teaching. This opens the door for teaching effectiveness programs, and helping faculty to use new pedagogies effectively. We are now encouraging faculty participation in seminars and workshops both inside and outside the university. We have not always paid much attention to this in the past.
- c) This is a continuous improvement process and having accountability is a good thing. If the term "continuous improvement" doesn't fit well, call it excellence. Excellence, teamwork and ethics are the foci of our Dean and these fit quite well with the ABET criteria."

We concur – excellence must be the focus of any effort to evaluate and improve engineering education.

Appendix Benchmark Schools and Contacts

#	Name	School/College	Email addresses
1.	Susan G. Haag, Ph.D. Director of Assessment and Evaluation (480) 965-7219	Arizona State	shaag@asu.edu
2.	William (Bill) Kelley. Professor of Civil Engineering (202) 319-5514	Catholic University of America Former ABET EAC Chair	wkelly@abet.org
3.	Ron Miller, Professor of Chemical Engineering (303) 273-3892	Colorado School of Mines	rlmiller@mines.edu
4.	Derek Lile, Professor of Electrical and Computer Engineering (970) 491-3537	Colorado State University	lile@engr.colostate.edu
5.	Joseph Hoey Director, Georgia Tech Office of Assessment (404) 894-0510	Georgia Tech	joseph.hoey@oars.gatech.edu
6.	Charles Yokomoto, Professor of Electrical Engineering (317) 274-9724	Indiana University- Purdue University at Indianapolis	yokomoto@engr.iupui.edu
7.	Dick Seagrave, Anson Marston Distinguished Professor (President-Elect of the ABET board) (515) 294-0518 Dennis Vigil, Associate Professor	Iowa State	seagrave@iastate.edu vigil@iastate.edu
8.	Daina Briedis Associate Professor, Chemical Engineering (517) 353-3861	Michigan State	briedis@egr.msu.edu
9.	Robert (Bob) Warrington Dean, College of Engineering, Michigan Technological University (906) 487-2005	Michigan Technological University	row@mtu.edu
10.	Joni Spurlin, Director of Assessment (919) 513-4626	North Carolina State	joni_spurlin@ncsu.edu
11.	Rob Pangborn (814) 863- 3750, Professor, Engineering Mechanics	Penn State	rnp1@psu.edu lus2@psu.edu

	and Associate Dean for Undergraduate Studies and International Programs Linda Strauss, Senior Project Associate (working on study for ABET) (814) 863-2655		
12.	Phil Swain, Dean, Office of Instructional Excellence and Lifelong Learning Professor of Electrical and Computer Engineering (765) 494-3443 Larry Huggins, Associate Dean for Resource Planning & Management Professor of Agricultural and Biological Engineering (765) 494-5349	Purdue University	pswain@purdue.edu huggins@purdue.edu
13.	Bart Sinclair, Associate Dean; Lecturer on Electrical & Computer Engineering (713) 348-6324	Rice	bs@rice.edu
14.	John Weese, Regent Professor of Mechanical Engineering, Engineering Accreditation Coordinator (979) 845-2302	Texas A&M	j-weese@tamu.edu
15.	Gordon Geiger Professor, Systems & Industrial Engineering - Academic Director, Engineering Management Program, Professor, Materials Science & Engineering (Formerly President of ABET) (520) 626-9451	U of Arizona	geiger@engr.arizona.edu
16.	David Auslander, Professor of Mechanical Engineering & Associate Dean for Research & Student Affairs (510) 642-7594 (510) 642-4930	U of California – Berkeley	dma@me.berkeley.edu
17.	Gary Ford, Associate Dean for Undergraduate Studies (530) 752-0556	U of California – Davis	geford@ucdavis.edu
18.	Terri Coleman, Management Services	U of California – Santa Barbara	coleman@engineering.ucsb.edu

	Officer (805) 893-7430		
19.	Raul Lobo, Associate Professor of Chemical Engineering (302) 831-1261 Dick Wilkins, Associate Dean of Engineering and Professor of Mechanical Engineering (302) 831-2006	U of Delaware	lobo@udel.edu wilkins@udel.edu
20.	Cammy R. Abernathy, Associate Dean for Academic Affairs (352) 392-0943	U of Florida	caber@ufl.edu
21.	Keith Hjelmstad, Professor and Associate Head of Civil Engineering (217) 244-8738 Narayana Rao, Professor and Associate Head Department of Electrical and Computer Engineering (217) 333-2302	U of Illinois at Urbana-Champaign	kdh@uiuc.edu rao@ece.uiuc.edu
22.	Gary Pertmer Assistant Dean of Undergraduate Student Affairs (301) 405-5284	U of Maryland	pertmer@umd.edu
23.	Jeanne Murabito Director of Academic Support Services (734) 647-7098	U of Michigan	murabito@umich.edu
24.	Clarence Waters Associate Professor, Architectural Engineering (402) 554-4958	U of Nebraska	cwaters@unl.edu
25.	Neal Armstrong Vice Provost for Faculty Affairs and Zarrow Centennial Professor in Engineering (512) 471-4363 Sherry Woods (512) 471-6744	U of Texas - Austin	neal_armstrong@mail.utexas.edu sewoods@mail.utexas.edu
26.	Chen-Ching Liu, Professor and Associate Dean 206-543-8590	U of Washington	liu@engr.washington.edu
27.	Sarah Pfatteicher Assistant Dean, Academic Affairs (608) 265-5925 (608) 263-3248	U of Wisconsin	spfatt@engr.wisc.edu

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1. ABET 2003 Annual Report (for ABET Fiscal Year 2002-2003), Page 2
2. ABET 2003 Annual Report (for ABET Fiscal Year 2002-2003), Page 26

Biographical Information

TERRY MAYES accepted the position of Director of Academic Programs & Assessment at CU's College of Engineering and Applied Science in February 2004 after serving nearly 5 years in development at the college. The majority of Mayes' career was spent at U S WEST, where she served as an expert witness in regulatory proceedings and was responsible for measuring client satisfaction with research work. Mayes has 3 degrees from CU.

JOHN BENNETT is a Professor of Computer Science with a joint appointment in Electrical and Computer Engineering at the University of Colorado at Boulder. He also serves as Associate Dean for Education in the College of Engineering and Applied Science. He joined the CU-Boulder faculty in 2000, after serving on the faculty of Rice University for 11 years. Bennett received his Ph.D. in 1988 from the University of Washington.