Assessment: How Much is Too Much or How Much is Not Enough?

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Introduction

The Department of Construction Technology of the Purdue School of Engineering and Technology (PSET) at Indiana University - Purdue University Indianapolis (IUPUI) has offered ABET accredited programs since 1984. The Department went through another accreditation visit in the Fall 2000 and was accredited for all of its programs till the next visit. Despite the comfort and reassurance this has provided, we have not lost sight of the fact that the next round of accreditation, based on ABET 2000 criteria for Technology (TC2K), will be challenging. Consequently, the Department is continuing its assessment work at full speed with the understanding that we need to do assessment and implement continuous improvement for the next six years if we want to keep our status.

Notwithstanding this continuing effort though, we are struggling with the question of what exactly needs to be assessed, how much, and is it possible to do it too much? Considering that assessment is really taking a toll on the scarcest resource of academic departments, faculty time, the question is a valid one. Since all faculty in our programs are technical professionals, it is in our nature to try to optimize everything we do and we are looking for a benefit/cost ratio that is feasible and defendable in this case too.

Even though the PSET houses a number of engineering and technology departments most of which are ABET accredited, there is no consensus or uniformity in terms of how to do assessment and how much. As a result some departments have opted to assess selected courses, some are assessing select courses plus a senior capstone course, some are assessing all courses, some are using comprehensive exams or portfolios, and some are using combinations of above in addition to the usual surveys, exit interviews, and such. As a result, the question lingers in terms of are we doing enough or are we doing too much. The question is more than academic in nature in the sense that significant resources or reputations are at stake.

This paper will focus on what the Department of Construction Technology intends to do in specific for its ABET assessment. Our plan is that our assessment will essentially entail assessment at several levels as a combination of assessing all courses plus a capstone course, exit exams and surveys, and involving the Industry Advisory Board in the process. The paper will also detail the total spectrum for different kinds of assessment activities being undertaken by different departments from the perspective of showing the wide range and scope. It is hoped that the presentation will lead to a lively discussion as to what is enough and what is too much and maybe bring out what the feelings are on this issue on the part of different administrators.

The Department Assessment Plan: Goals, Objectives, and Continuous Improvement

For developing the Department assessment plan we identify five constituencies that benefit from our programs: the students, the faculty, industry, the community, and the profession. In parallel with this, the vision statement, the mission statement, and the goals and objectives of the Department of Construction Technology were developed through a very participative process involving the three Industrial Advisory Boards for all programs, students, and faculty, taking care to ensure conformity of these with the School and University missions. For sake of brevity these have not been included here.

The second step was establishing the Specific Educational Objectives in conformity with the objectives by the University (IUPUI) in terms of what is called Principles of Undergraduate Learning (PUL) and the ABET objectives, a-k, as our accrediting body. The PUL objectives are mainly:

- Core Communication and Quantitative skills (such as writing, reading, speaking, listening, quantitative analysis, and use of information technology);
- Critical Thinking (a sophisticated cognitive process involving the careful examination of ideas and information from multiple perspectives in order to clarify and improve understanding, and to develop ideas that are unique, useful, and worthy of further elaboration);
- Integration and Application of Knowledge (articulation and application of concepts or constructs from two or more disciplinary areas to personal, academic, professional, or community activities); and
- Intellectual Depth, Breadth, and Adaptiveness (the ability to examine, organize, and apply disciplinary ways of knowing to specific issues);
- Understanding Society and its Culture (the ability to place one's own cultural traditions in a broader human context).

The ABET objectives, a-k, are well known to the reader and are not repeated here. The Department has made sure that each syllabus specifically stated which of the PUL and ABET objectives were being addressed, as well as, making clear what the specific course objectives were in terms of the area of the course.

As the third step, a schedule according to which different things will be assessed was agreed on as shown below:

Assessment Schedule

Mission, Goals, and Objectives - every three years
Curriculum - every two years
Individual Courses - 25 % of courses every year
Faculty - every year
Facilities - every year
Graduates - at every six months and two years after graduation

1.   Assessment of the Mission, Goals, and Objectives of the Program

a.   Review by Industry

The Department will send a copy of the following items to the members of the industrial advisory board. A cover letter will ask for the participants to review and provide comments.
a. Current Mission, Goals, and Objectives
b. Current curriculum
c. Statistics for the last three years showing student head count, graduation rate, faculty information, and any other information that the industry advisory board may request.

Comments received are to be reviewed for consolidation and action. A meeting of the Industrial Advisory Board (IAB) is scheduled every Fall to review and make appropriate recommendations to the Department. The Department Faculty will meet and revise/approve mission, goals, and objectives as appropriate after the IAB meeting.

b.   University Requirements

The Department will compare the revised department mission, goals, and objectives with the university mission, goals and objectives to ensure that there are no conflicts. Action will be taken as appropriate by faculty in case of conflicts.

2.   Assessment of the Curriculum

a.   Accreditation Organization Requirements

The Department reviews the current ABET accreditation and university requirements and notes any discrepancies between requirements and the current curriculum. Appropriate faculty will be appointed to take action to correct the discrepancies as needed.

b.   Review of Curriculum by the IAB

The Department will send a copy of the following items to the members of the industrial advisory board (IAB). A cover letter will ask for the participants to review and provide comments by a deadline.
                   a. Current curriculum
                   b. Current syllabus of each course in curriculum
                   c. Accreditation and university requirements
                   d. Any other information the board may request
Comments received by the Department are consolidated for review and action. A meeting of the IAB will be held every Fall to review and make appropriate recommendations to the department. The Department will meet and consider the suggestions and make the changes, as appropriate.

c.   Review of Curriculum by Alumni

The Department will send a copy of the following items to a focus group of alumni or members of the IAB who are our alumni. A cover letter will ask for the participants to review and provide comments by a deadline.
>   a. Current curriculum
>   b. Current syllabus of each course in curriculum

Comments received are consolidated for review and appropriate action taken through subsequent department meetings.

d.   Review of curriculum through Capstone Course

The instructor for the Capstone Course will use the IAB to have a review and get comments on the content and quality of work completed by the students. This review will include consideration of student's ability to be productive and knowledgeable in entry level position in the industry. The review is to also consider the Department's Goals and Objectives in evaluating the material. The instructor and the IAB will make recommendations for improving curriculum as appropriate. The Department will take action on the recommendations and provide feedback to the Board.

e.   Review of Curriculum through Graduate Exit Examination

As a requirement of graduation or program completion, all students will be required to take the Certified Professional Constructor examination administered by the American Institute of Constructors (AIC) or another exam to be developed as appropriate. The faculty will receive copy of the results of this examination each semester and discuss them at the department meetings. Any recommendations and suggestions resulting from this review will be acted upon by the faculty, and results reported to the IAB at the next meeting. Students will be encouraged to take other appropriate exit examinations such as NICET, etc., and the results evaluated similarly.

3.   Assessment of Individual Courses

a.   Course Assessment Schedule

The program courses will be assessed, in groups, each year, over a four-year period, by the faculty and the IAB, starting with Senior level courses the first school year and working backwards. By September of each year, the Department will develop and distribute to faculty, a list of courses, with responsible instructor and industry representatives assigned.

b.   Instructor's Assessment Activities

The instructor will develop a plan for assessment of the course with the assistance of the industry representatives and/or IAB. The instructor will report the results of assessment and any action taken to the Department.

c.   Students' End of Semester Evaluation of the Course

The student evaluations will be reviewed in department faculty meetings each semester, as appropriate. A list of action items will be developed and acted upon. A report of these items and action taken will be posted on the web for students to review.

d.   Industry Review

In addition to the industry representatives working with the individual instructors, copies of the syllabus and other course material will be sent by the Department to the IAB members according to their specialty. Their comments will be collected and passed on to the appropriate faculty.

4.   Assessment of Faculty

a.   Peer Evaluation by other Department Faculty

In-class peer evaluation of full-time department faculty will be done on a voluntary basis by other full-time faculty as requested. This is especially advised for faculty on tenure track since tenure/promotion process requires peer review. The reviewer will make comments and suggestions for improvement. Each faculty member will present a written and oral report of action taken to improve his/her teaching method for that course to department faculty. In-class evaluation of part-time faculty will be done by the Department Chair.

b.   Evaluation of faculty by Students

End of semester evaluations by students for each course will be reviewed by the Chair and each related individual faculty and appropriate action will be taken by the following semester.

c.   Evaluation by Alumni

Comments received, if any, from a focus group of alumni in relation to a faculty member will be addressed by the department faculty in department meetings each year being careful about privacy and sensitivity issues.

5.   Assessment of Facilities

a.   Evaluation of facilities by Faculty and Staff

Each year faculty and staff will meet to discuss the condition and use of the various department labs and classrooms. The library resources will also be reviewed. Recommendations will be acted upon by the Department and a report distributed to all faculty and staff.

b.   Evaluation of facilities by Students

End of semester student evaluations include an opportunity for comments about department facilities by the students. The student evaluations will be reviewed in department meetings each semester. A list of action items will be developed and acted upon. A report of these items and action taken will be posted for students to review, by the first week of the following semester.

6.   Assessment of Alumni

a.   Evaluation of Alumni Surveys

The University surveys alumni that have been out 2, 5, and 10 years every year. The results from these surveys will be reviewed in department meetings each semester. A list of action items will be developed and acted upon. A report of these items and actions taken will be sent to graduates completing the survey and to IAB.

b.   Evaluation of Employer Surveys

The School of E&T conducts employer surveys according to the frequency described above. The results from these surveys will be reviewed in department meetings each semester. A list of action items will be developed and acted upon. A report of these items and action taken will be sent to the employers completing the survey and to industry board members.

7.   The Annual Report - Content and Format

The annual assessment report will be prepared by the Department and distributed to faculty, staff, IAB members, and the Dean. It will contain the lists of action items generated during the school year, what action was taken, and by whom, if appropriate.

Throughout the year, copies of reports of actions (with backup materials) generated through above assessment items will be forwarded to the Department for preparation of the annual report.

8.   The Feedback Loop

All syllabi were required to have ABET and PUL objectives and course specific learning objectives clearly shown in them by May 2000. The School has instituted a policy of not granting any approval to any new course that is proposed without detailing these objectives. Forms have been developed for new course requests to show which objectives the course is specifically addressing.

Course syllabi are being reviewed and redesigned, as appropriate, to address the achievement of general education (PUL) and ABET/TAC principles. A matrix has been constructed for all courses offered by the Department that shows which general education objectives are targeted to be fulfilled in which courses and faculty have started creating rubrics for assessment of this mastery in their courses. At this point, the Department faculty are in the process of assessing the mastery of the objectives included in the courses through use of appropriate course undertakings, evaluation rubrics, and statistical measurements.

In line with incorporation of PUL and ABET objectives into syllabi, faculty are also undertaking a critical look at the learning objectives for each course. IAB members will be reviewing all the syllabi and providing input in this respect in due course as detailed above in the Department assessment plan.

The level of knowledge of course content is assessed in traditional ways such as: tests and quizzes, oral reports, class projects (individual and team), homework, papers, etc. Due to the experiential nature of many of our classes, non-traditional ways of evaluating student knowledge is also used. For example, students turn in team projects and may take team quizzes. Students' individual grades are often influenced to some degree by the efforts of team members. Students sometimes argue that the work of their team members should not affect their grade. Every effort is made to address these concerns and appropriate models for evaluating teamwork are applied.

Each course syllabus contains a clear explanation of how student performance is assessed and how grades are determined for each assessment activity. It has been agreed that all faculty will provide Instructional Objectives to students at least for the mid-term exams and the final to ensure that the students understand what they will be evaluated on and will need to know. Ideally, grading rubrics will accompany these instructional objectives. All syllabi are reviewed regularly by faculty for these essential ingredients. The department believes that timely, accurate, and specific feedback is essential to student learning and performance. Each professor is asked to provide this level of feedback for each class taught.

There is some inherent subjectivity in grading due to the nature of the subject matter and the evaluation techniques used in measuring student learning. For the most part, the faculty evaluates student performance fairly and adequately.

The School Assessment Framework

Purdue School of Engineering and Technology at IUPUI houses a number of engineering and technology departments most of which are ABET accredited. The following table shows what each department in the School has chosen for its main assessment strategy. Examination of the table indicates that there is no consensus or uniformity in terms of how to do assessment and how much. As can be seen, some departments have opted to assess selected courses, some are assessing select courses plus a senior capstone course, some are assessing all courses, some are using comprehensive exams or portfolios, and some are using combinations of above in addition to the usual surveys, exit interviews, and such. As a result, the question lingers in terms of are we doing enough or are we doing too much. The question is more than academic in nature in the sense that significant resources or reputations are at stake.

Table 1. Characterization of the Departmental Assessment Processes.

Department	ABET or PUL?	Primary Strategy	Supplemental Strategies
Computer Technology (CPT)	ABET/TAC	Assessment in all selected courses	Assess how well students feel they have learned the course outcomes using surveys Develop rubrics for more courses Assess retention rates, graduation rates, and number of degrees conferred Assess how well students feel they have learned the course outcomes using surveys Assess continuing students satisfaction using in-hours survey Assess alumni satisfaction Assess employer satisfaction
Construction Technology (CNT)	ABET/TAC	Assessment in all courses + Assessment in a capstone course + exit exams + student and alumni surveys	Assess how well students feel they have learned the course outcomes using surveys Assess retention rates, graduation rates, and number of degrees conferred Assess retention rates, graduation rates, and number of degrees conferred Assess continuing students satisfaction Assess alumni satisfaction Assess employer satisfaction
Electrical and Computer Engineering (ECE)	ABET/EAC	Assessment takes place in selected courses with strong emphasis on the senior capstone course.	Assess how well students feel they have learned the course outcomes using surveys Assess retention rates, graduation rates, and number of degrees conferred Assess continuing students satisfaction using in-hours survey Assess alumni satisfaction Assess employer satisfaction
Electrical Engineering Technology (EET)	ABET/TAC	No information at this time	Assess how well students feel they have learned the course outcomes using surveys Assess retention rates, graduation rates, and number of degrees conferred Assess continuing students satisfaction Assess alumni satisfaction Assess employer satisfaction
Mechanical Engineering (ME)	ABET/EAC	Assessment takes place in a selection of courses, which includes the senior capstone design course.	Assess how well students feel they have learned the course outcomes using surveys Assess retention rates, graduation rates, and number of degrees conferred Assess continuing students satisfaction Assess alumni satisfaction Assess employer satisfaction Exit interview
Mechanical Engineering Technology (MET)	ABET/TAC	Comprehensive exam or portfolio, depending on the degree program	Assess how well students feel they have learned the course outcomes using surveys Assess retention rates, graduation rates, and number of degrees conferred Assess continuing students satisfaction Assess alumni satisfaction Assess employer satisfaction
Organizational Leadership and Supervision (OLS)	PUL	Assess selected courses, including the required senior research project course	Graduating senior survey Passing rate on certificate program Assess retention rates, graduation rates, and number of degrees conferred Assess continuing students satisfaction Assess alumni satisfaction Assess employer satisfaction

What is Enough ?

In our opinion as a Department, trying to assess a B.S. degree through a single course, whether it is called a capstone course or a Senior Design course, is a futile attempt and conflicts with the basic premise of assessment being a process to determine what has gone wrong and where and trying to do something about it. Considering the fact that ABET 2000 "criteria a-k" encompass a large range of objectives so varied in nature that thinking that one can assess all of these in a single course is surely an indulgement in extreme optimism. I have often likened the situation to how specifications related to compressive strength of concrete has evolved over the years. At the beginning everything that was to go into the mix of a concrete batch was specified in detail in terms of amount of cement, water, sand, aggregate, as well as, mixing time and etc etc. (very much like the "bean counting" methodology of previous ABET criteria). Then, to allow for expertise of contractors and mixing plants to be incorporated into the process, the way to specify concrete was reduced to just specifying the 28 day compressive strength, with no minimums essentially being foreseen for any of the ingredients. This seemed to work for some time and savings in amount of cement used etc was achieved. However, the more relevant consequence became apparent after several years when bridge decks started deteriorating and failing and thus requiring expensive repairs. This was mostly due to the fact that even though the strength specified was achieved, not enough cement was put in the mix to protect the reinforcing bars against the effects of the environment. I am hoping that ABET is not falling into the same trap by not making it clear what the minimum expectations are in terms of what needs to be assessed and when and where.

As Mikel Harry and Richard Schroeder state in their famous book, Six Sigma Breakthrough Management Strategy (1),

> "We do not know what we do not know
> We cannot act on what we do not know
> We won't know until we search
> We won't search for what we don't question
> We don't question what we do not measure."

So, in assessment, unless we measure what we value, it essentially means we do not value it and it practically is impossible to measure everything in a single course, whatever is the course title.

Conclusion

It is natural that some variation will exist in how assessment work towards accreditation is carried out by different departments in a school of engineering and technology. As engineers we all cherish the premise that there can be several solutions to a problem, all equally or acceptably valid. However, it is also a known fact in the industry that too much variation in essentially the same product is indicative of lack of appropriate control and of inherent quality problems. It probably is already clear that the educational institutions will not be able to address and bring a consensus or compromise to this dilemma on their own. In the mean time significant resources

are being wasted on assessment undertakings in the absence of any guidance or policy statements by ABET. ABET will provide a great service and leadership to all accredited programs if it made clear what is enough and appropriate.

Bibliography

(1) Mikel Harry & Richard Schroeder., *Six Sigma – The Breakthrough Management Strategy*, Random House, New York, 2000.

Biography

Erdogan M. Sener., Professor and Chairman at the Department of Construction Technology of Purdue School of Engineering & Technology at Indiana University – Purdue University Indianapolis (IUPUI). B.S. Civil Eng., Middle East Technical University; M.S. Civil Eng. Michigan State University. He has over 13 years of international industrial experience in design and construction and has been in engineering and technology education for more than 18 years. Member of ASCE, ASEE, ACI, president of the Construction Engineering Division of ASEE, and is a registered Professional Engineer in Indiana. Prof. Sener was awarded numerous teaching awards including the Indiana University President's Award for Distinguished Teaching in 1993 and the IUPUI Chancellor's Award for Excellence in Teaching in 1994.