AC 2012-3601: GETTING ABET ACCREDITATION RIGHT THE FIRST TIME

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Getting ABET Accreditation Right the First Time

Abstract

This paper describes the authors' experiences in securing ABET accreditation for a new Computer Engineering and Systems (CES) program. Though some programs at the university had received joint accreditation in conjunction with similar programs at the main campus, the CES program was the first program to receive national accreditation on its own. How we dealt with the challenges we faced, and the lessons we learned in the process are discussed in detail in this paper.

Those seeking first-time program accreditation should take advantage of preparation workshops given by ABET and professional societies. Early in the preparation cycle they need to identify the criteria that are applicable to the accreditation being sought. It is never too early to start preparing for accreditation. Every program must have clearly defined and documented objectives; ABET requires that program constituencies be involved in setting objectives.

When objectives are in place, ABET student outcomes need to be mapped to individual courses. Next, assignments are identified that can be used to evaluate the achievement of the outcomes. For many programs specific program criteria need to be satisfied in addition to the general engineering criteria. For example, engineering programs that contain the modifier "computer" in the title must demonstrate that graduates have a knowledge of discrete mathematics.

Having an assessment plan in place and being able to show documentation that demonstrates that it has been followed is the next step. That includes having a documented advising system in place for the current students and a tracking mechanism for graduates. Student transcripts sent to ABET need to be checked prior to any accreditation visit and clear explanations atypical situations must be documented.

Preparation for the visit should include educating the faculty, staff and administrators on the roles they will play. It is particularly important to help faculty from service units, who are not familiar with the ABET accreditation process. Students need to understand the importance of their role in the process too. Facilities need to be checked prior to the visit with any safety concerns or accessibility issues properly addressed.

An advisory board should be established well before starting an accreditation process. Their participation in all stages of the accreditation process, including in the evaluation visit, is highly recommended. Under the current budget shortages across the universities, it is important show that there are solid plans for maintaining the laboratories current and for providing the junior faculty with adequate develop opportunities.

Our final observation is that it is much easier to succeed when all involved in accreditation work together as a team. The effort involved in preparing for an ABET visit is far too great

for just one or two individuals. Active participation of the entire team is important to achieving the goal of accreditation.

Start Preparing Early

In out case we referenced the ABET criteria on objectives and outcomes when designing the curriculum for the new program. We used this approach to ensure that we covered all the educational outcomes prescribed by ABET. As part of the 'start early' philosophy, consider having one or more of your faculty volunteer to be program evaluators. Evaluators get invaluable training that should make preparing you self-study easier.

For programs that don't have the advantage of having program evaluators on the faculty, find other means of getting help. Most, if not all, of the professional societies offer workshops to help to help programs preparing for accreditation. Organizations like the Electrical and Computer Engineering Department Heads, ASEE, and ABET all have had sessions at conference on how to prepare for accreditation. Take advantage of this type of help early in your preparation cycle.

We also started early identifying the program's constituents so that we could get their input on the program's objectives. As part of this process we met with our Industrial Advisory Board to get their ideas and suggestions on objectives. We were also careful to document the involvement of the IAB and other constituents in the objective setting process. For our case, this was done by creating a notebook that included minutes from all relevant meetings.

A final suggestion in this area is that you get a copy of another school's self-study document long before you start preparing yours. One bit of caution is needed here: be sure to check the ABET criteria to make sure that you are following the criteria applicable to the year in which your program will be visited. The Criterion does change from year to year and you are responsible for using the applicable version.

Student Information

This is another area where a little time spent early can save a lot of work during and after the visit. ABET will request transcripts of a number of your recent graduates prior to the visit. The program evaluator will go through the transcripts with a fine-tooth comb to see if your graduates followed all of your policies and procedures. They will check the units students accumulated in each area; they will check to see if your students completed all prerequisite classes before taking advanced classes; and they will check to see if all catalog requirement have been met.

Part of the reason ABET is so careful evaluating transcripts is that it gives the evaluator a feel for how effective your advising system is. If, for instance, a transcript show that one of your students was allowed to graduate with only a statistics course on his transcript rather than the required probability and statistics, you better have documentation to explain why this was allowed. For one of our students who had only taken statics, we documented how

his capstone project involved learning and applying probability theory to a design problem. Be sure your student advising records document any discrepancies between what students have done and what they were suppose to do.

Program Objectives

Assessing how well your graduates have achieved your program objectives is usually difficult for programs that have only produced one or two graduating classes. In our case, we had one group of graduates who had one year's experience. With so little experience it was not surprising that only a few of the graduates had achieved some of the program objectives. However, we were able to show that we had a plan in place to assess achievement of objectives and that we were prepared to apply the process when the graduates had been in the field between three and five years.

Program Outcomes

Your program's learning outcomes and the process you use to assess them and apply the assessment data to improve the achievement of the learning outcomes is critical for getting accredited. It is our impression that ABET looks more favorably on assessment processes that include "direct assessment" than those that only employ "indirect assessment." Because of this, we directly assess achievement of learning outcomes in upper division classes [1,2].

Deciding where to access individual learning outcomes is a critical step in preparing for accreditation. We started by developing a matrix that has a row for each required course in the program and a column for each outcome. The content of each cell of the matrix indicates whether or not the course supports achievement of the outcome in that column or if the course is where the outcome is assessed. Creation and use of this type of matrix in well documented in [3].

For each of our program's learning outcomes, we have developed specific types of assignments in different courses where outcomes are assessed. To try to maintain consistency when different instructors teach the classes, we have developed rubrics for grading the assignments. And finally, to try to reduce the amount of work required of the faculty, we have developed spreadsheets that simplify the collection of assessment data.

We must admit that we do also use indirect assessment in the form of senior exit surveys. The data from this indirect assessment gives a bit redundancy in our process.

Several of the ABET outcomes do not focus on the technical details of engineering. Instead, the so-called "soft outcomes" assess the students' awareness of the impact engineering has outside the discipline. If the purpose of technical engineering courses is to empower students, then these outcomes examine how future engineers might wield that power.

In our program these outcomes are primarily assessed as part of a cyber-ethics course. This course focuses on reason, philosophical ethics, and examining methods of thought for

evaluating how humanity should conduct itself. As such, it is an ideal forum for exploring how technology has impacted humanity, the environment, the economy, etc. Students are exposed to numerous case studies of technological development and impact, such as the influence of encryption on intellectual property rights and vice versa. After gaining a little experience in using various intellectual tools for evaluating consequences, students are then required to synthesize their own evaluation of a novel technology. This process requires the students to consider, and attempt to balance, the professional, cultural, and moral expectations placed upon them.

The non-technical nature of the above process makes outcome assessment more vulnerable to subjective variation. However, in designing our assessment method, we decided to treat the "soft outcomes" no differently than any other outcome. For each outcome, we identified a set of key skills and/or areas of knowledge. For example, to assess students' "knowledge of contemporary issues," the students are evaluated in five broad areas of knowledge: privacy, intellectual property, security, social impact, and environmental impact. Students demonstrated satisfactory competence in these areas through the regular written work of the course, but could alternatively have been evaluated via worksheets or quizzes. While it is difficult, if not impossible, to determine whether a student as internalized the above issues, we are confident that we can assess the effectiveness of the topic exposure students receive. As we conduct further assessments, we expect to refine both the areas in which students are evaluated and the methods of evaluation.

A final suggestion seems appropriate here. Remember that it is not necessary to report assessment data on every student going through your program. That means you don't have to conduct a formal assessment each time you teach a course in which an outcome is assessed. For programs going through their first ABET visit, however, you will have to show that all outcomes have been assessed.

Continuous Improvement

Reams of assessment documentation serve very little purpose if they are not put to use. Indeed, a significant point of the entire exercise is to demonstrate that no matter where in the quality spectrum your program falls, you are prepared to improve it. We believe that this is an essential point to demonstrate to ABET.

As Shiba and Walden point out "Implicit in the concept of focus on process is the idea that any activity can be improved if you systematically plan the improvement, understand the current practice, plan solutions and implement them, analyze the result and its causes, and cycle through these steps again." [4]. We embrace the idea of *process* being the key to continuous improvements as three example process changes discussed below demonstrate. Continuous improvement typically implies many small changes rather than giant leaps. In that spirit, we describe below three such chances we made.

Freshmen Engineer Involvement in the Capstone Project [5,6,7] is an example of "customer-driven" change. Senior students involved in the capstone project had expressed

some frustration that they had spent much of their time on tedious tasks such as soldering and finding parts. Freshmen engineers, on the other hand, had expressed a desire to get more "hands on" time in with projects in a laboratory. The planned solution was to pair freshmen acting as interns with seniors working on capstone projects. This was implemented and student evaluations were studied. Freshmen reported that they were bored the first quarter of the capstone because the seniors were spending most of their time writing; the seniors complained that they were distracted early on by having to try to find something for the freshmen to do while they were planning their projects. The second process change, then, was to have the freshmen be involved only in the second quarter of the capstone project. Student evaluations from both the seniors and freshmen were much more positive after this change. We will continue to evaluate this process.

Revised Capstone Project Assessment is an example of an ABET evaluation-driven change. It became clear through internal reviews and ABET comments that we did not specifically assess how students applied realistic constraints in the design constraints specified in ABET outcome c) to their design process. To remedy this the syllabi for the capstone courses was changed and in turn, changes were made to course lectures and the ways that we mentor students through the design process. This was a relatively minor change, but we believe that it enhanced the capstone experience in a positive way as evidenced by comments on student evaluations. It also made it more obvious to the evaluators that we were in compliance with the intent of ABET Outcome c).

Revised Laboratory Safety Standards was an ABET onsite visit-driven change. The ABET team made a suggestion that we improve our safety procedures in order to comply with best practices. We immediately made changes that included a review of our Material Safety Data Sheets (MSDS) in order to make sure we are fully compliant with state and federal regulations, to increase the number of safety glasses that were available in our laboratories, to make sure that our students knew when they must wear safety glasses, and to make sure our students knew to use the ventilation equipment when soldering. Through both increased verbal guidance and posted signage our students became more safety conscious as evidenced by observed greater use of safety equipment. Through this exercise, however, it became obvious that our safety *process* was lacking. As a result we have implemented an ongoing review of all of our safety practices.

Faculty

Try to reduce the faculty workload associated with assessment and accreditation visits as much as possible. For example, ABET requires a short resume for each faculty member; provide the faculty with a simple template that they can fill out rather than just ask them for resumes. This will save everyone time and frustration. Having faculty store course materials on Moodle [8] has also saved time and effort. Since Moodle holds a complete collection of all course documents (course syllabi, students' assignments and activity reports, instructors' grading and feedback, etc.) time spent preparing for the ABET visit is reduced.

One positive thing we noticed during our preparation for ABET accreditation is that the process has really promoted the faculty development in teaching and research. Having regular meetings with discussion about assessment helped educate all faculty about the assessment process. Junior faculty mentioned that being part of the assessment discussions helped them improve their teaching. In addition, their efforts and experience in teaching effectively has motivated them get involved in research in the engineering education [4,5].

Hopefully, all of your faculty are familiar with your assessment program and have been involved with improving your program. One of the worst things a faculty member can say to an evaluator is, "Oh, Joe takes care of the accreditation stuff and I don't have to get involved." Be sure everyone can talk intelligently about your process on the day of the visit. You will also help keep evaluators happy if you make sure faculty are on call and available when evaluators are ready to talk.

Facilities and Support

How one responds to these criteria is critical to the accreditation process. On the laboratory facilities it is important to document the existence of enough equipment and components to maintain the courses and to conduct the capstone projects. It is also important is to have adequate staff to maintain the lab facilities and to help with course design and delivery. In our case, that required an extensive negotiation with the upper administration as the visit coincided with a period of budget shortage and hiring freeze. On the other hand, it is necessary to show to the evaluators that you have a replacement and/or expansion plan in place, even if funding is pending or difficult to obtain.
Having adequate support may be difficult to demonstrate. Again, in our particular situation this was a problem because the accreditation process occurred during a period of severe budget cuts that included elimination of faculty and staff positions. Essential points to cover in your support plan include resources for faculty development and commitment for replacement of retiring or departing faculty. The latter is particularly critical for small programs.

For us one issue that was particularly difficult to explain: funding for faculty travel. Travel to present research results at conferences is critical for the development of the faculty and their success in progressing through the academic ladder. Like in most state universities we were very limited in terms of out-of-state, not mention out-of-country travel. But between the time the self-study was written and the accreditation visit our administration did find a way to support faculty travel through exchange of resources between state and non-state accounts.

Program Criteria

We have one piece of advice here: make sure your self-study is prepared using the criteria applicable to the year of your visit. The criteria does change and we missed a new requirement and had to go back at the last minute to change our process to adapt to the new requirement.

Preparing for the Exit Interview (coaching the administrators)

One of the critical parts of the visit by the ABET team is the interaction with the campus administration. Our experience comes from different sides of the interaction process; we have been faculty members in programs under accreditation, chairs of these programs, dean or director with authority over them, and ABET evaluators.

Because there are many aspects of the evaluation process that extend beyond the limits of a department or program, it is necessary for the ABET team to meet with campus administrators at various levels. It is the obligation of each program to prepare the administrators for such meetings. And it is important that the administrators have previous knowledge of the accreditation process and of what kinds of questions will be asked by the visitors. It is also crucial that their responses are consistent with what has been written in the self-study, except for matters of opinion.

It is very common – and in our view acceptable – that program chairs and faculty use the accreditation visit to enhance the importance of their requests for support from the upper administration. However, acting as evaluators, some of us have seen disparate points of view, conflicting data and even excessive criticism of the administration. These actions usually do not help the program, the administration or the accreditation process.

In our particular case, there was tension between the program and the campus administration, in particular regarding the handling of the budget process in the year preceding the accreditation visit. But we restrained ourselves from being overly negative about the administration's tactics either in the elaboration of the self-study or during the visit. Similarly, the upper administration and all the intermediate level directors (library, admissions, final aid, computer services, etc.) did show support for the new program. More importantly, they did show knowledge of the statements we made in the self-study and of the challenges we faced during difficult budgetary times.

Summary and Conclusions

In summary, we recommend that you:

- Start preparations as early as possible, ideally when the program is designed;
- Take advantage of resources such as ASEE, ABET, and IEEE workshops;
- Get trained as a program evaluator;
- Learn from other programs' self studies;
- Be prepared to explain any issues associated with student transcripts and records;
- Use direct rather than indirect outcome assessment.
- Have rubrics defined to ensure consistency in assessment;
- Assess soft outcomes using direct methods;
- Assess programs, not individual students;
- Document all assessment and improvement activities;
- Provide templates and guidelines to reduce the assessment workload on faculty;
- Educate all faculty on your assessment process and its results;

- Use the most current criteria when preparing your self-study; and
- Educate administrators and prepare them for the visit.

As a final note, when accreditation is first granted, it applies to the class that graduated the spring prior to your accreditation visit. In our case one class had graduated a year before our visit but we requested that the first graduation class also be allowed to claim they were from an accredited program. We provided transcript evidence that demonstrated that the first graduating class met the same requirements as the most recent class and ABET agreed that the first class also qualified as being from an accredited program.

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