

EC 2000 From Both Sides of the Fence

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Introduction

I have served as an ABET EC2000 evaluator for three EC2000 visits and was department chair during an EC2000 visit of my own home department in Fall 1999. I have been a faculty member at the University of Toledo long enough that I have experienced four ABET visits during my tenure, two as a faculty member and two as a department chairman (three under the "old" guidelines and one under EC2000). This paper is a discussion of my perspective of the "new" EC2000 guidelines as both a department chair and a program evaluator.

The Old Guidelines vs. The New Guidelines (EC2000)

In many respects, I have the same feelings about EC2000 from both perspectives (or both sides of the fence). The areas that I find difficult to document and provide as paper trail for are the same areas that I find difficult to evaluate in other programs. I realize that the EC2000 guidelines are much less prescriptive than in the past and have less "bean-counting" involved. Many times as a department chair, and sometimes as an evaluator, I find myself longing for the good old bean-counting days. You at least knew what the target was back then, even if it occasionally moved, and you sometimes didn't hit it. The most prevalent controversies, as I recall, seemed to center on the design content of the curriculum. A certain number of engineering science and engineering design hours were required for an accredited program. Documenting sufficient design content was always the sticky part of the accreditation visit... "I think this course is 2.5 hours engineering science and 0.5 hrs engineering design." Design content seemed to be in the eye of the beholder, and was one of the only criteria open to debate. The other criteria were quite prescriptive (x hrs of mathematics and basic science, y hours of humanities and social sciences, etc.). We complained a lot about the criteria back then, and said things like "If we only had a little more flexibility in the curriculum, we could...". Well, perhaps we should have been a bit more careful what we wished for, we now have the flexibility to design the curriculum as we see fit, within broad guidelines, but I'm not sure that we're any happier. I believe we should be happier, however. EC2000 is an effective process for helping improve our curriculum. The paperwork and record keeping can be onerous at times, but ultimately, we will have better, more effective programs for all the effort involved.

The Paper Trail

With EC2000, the curriculum requirements are more flexible. Along with these newly found freedoms, however, we have picked up the additional burden of documenting somehow that the students are actually learning the material. It's no longer sufficient to merely say that we are presenting all the right topics to our students, but we must be able to prove that they are indeed learning the material. That's the whole concept of outcome-based assessments. I personally believe that this is a good thing, but I have learned to welcome (as well as dread) the necessary processes that go into documenting student learning.

From the standpoint of a department chairman, the necessary record keeping and data analysis tasks are overwhelming. Even if the faculty is supportive, as my colleagues are, it takes a complete change in departmental culture to make the EC2000 process effective. It's not enough to have a single champion or two on the faculty to make the process work. It has to become second nature to the faculty and the normal way of doing the business of teaching. This is a difficult task at best, as I've observed in my home department, as well as in my visits as an evaluator. Adjusting to change takes time and persistence, and outcome-based assessment is a *big* change, from the way most engineering programs have functioned in the past.

Program Educational Objectives

We must formulate Program Educational Objectives (PEOs) in conjunction with our constituencies. In my experience this issue seems to cause programs much difficulty. The PEOs are very important, as all the elements of the program must work in concert to attain the objectives. The biggest downfall that I've noted in the formulation of PEOs is when the faculty (or worse yet, one or two faculty only) acts unilaterally to develop the PEOs, without sufficient input (any) from other program constituents. What usually happens in this scenario, is that the faculty develops the PEOs, and merely informs other constituents (students, alumni, industrial advisory boards) what they are. Even when this is the situation, departments will not keep sufficient records to demonstrate that the other constituents were ever informed of the PEOs. "Well, we placed them on our web page..." is not sufficient involvement of the constituents. Be prepared to document, with meeting minutes and agendas (from Industrial Advisory Boards, student groups, etc.) the discussion and development of the PEOs. If there is one thing I've learned, on both sides of the fence, it's that a paper trail is crucial to documenting the process. Your program may have absolutely outstanding PEOs, but if you cannot demonstrate that they were developed in conjunction with your constituencies, the evaluator will be forced to cite the program for this.

Outcomes

Another very important piece of the EC2000 process is the Program Outcomes. These should be customized for your particular program and not consist merely of the well-known "(a) through (k)". The outcomes must fully incorporate "(a) through (k)", but should also reflect the unique nature of your particular program. In addition, the Program Outcomes should (must) be mapped to specific courses and Course Objectives throughout the curriculum, so that the evaluator (and

your own faculty for that matter) see how all the individual pieces in the program fit together to accomplish the PEOs. The faculty needs to be aware of the process and some of the basic terminology, so that they can demonstrate to the evaluator that they are "on-board" and part of the outcome-based assessment in the department. One of the worst things that can happen, from a department chair's as well as an evaluator's perspective, is to have several faculty members in the department be clueless regarding the process. They don't all need to be experts, however, they should be aware of the process. In the final analysis, the faculty is ultimately responsible for the curriculum, and the EC2000 process is the mechanism that we must use to evaluate its effectiveness.

Teaching and Learning

Are the students learning what they're supposed to be learning? We're teaching it, but are they learning it? We must be able to document the results as part of the EC2000 process. Again, a paper trail here is very important. Being able to visit other institutions as an evaluator has been beneficial to me because I have been able to observe some of the techniques and tools that others use to document student learning and outcomes. One school that I visited had some very specific Course Objectives that were tied back to the Outcomes and the PEOs as required. This is not unusual. The unique thing they did was to have faculty members in the various courses identify homework problems or test problems in the class that demonstrated competency in a particular course objective. The faculty members then kept grade logs of these particular problems to demonstrate that, for example, 85% of the students in the course scored above a 70% on problems related to Course Objective No. 1. As an example of this, consider a course in Process Heat Transfer. One of the course objectives might be to design/size a heat exchanger for a particular process application. Accomplishing this course objective would tie back to outcomes related to ABET Criteria 3c (the ability to design a component to meet desired needs) and 3e (the ability to formulate and solve engineering problems). The instructor would then keep track of which problems in the course related to designing/sizing heat exchangers for a particular application. This students' performance on those problems could then be used as evidence of their learning this particular skill and satisfying the desired outcomes.

The Feedback Loop

Documentation of the feedback from the process and modifications made in response to the analysis of the feedback are also very important for the department and the evaluator. For the process to be fully implemented, the department must be able to demonstrate some positive actions that have been taken as a result of the assessment process to modify the program for the better. Whether the department has a retreat each semester or once/year, it is essential that documentation be kept about what was discussed, what was changed, why it was changed, and how the constituents were involved in the change process. One interesting assessment tool that I observed on a visit was the use of Course Summaries. At the end of each term, each faculty member prepares a Course Summary for the course(s) they have just completed teaching. In the summary, they addressed things that went well in the course, things that didn't go as planned and that they would change the next time, as well as any deficiencies noted in the students' preparation from the prerequisite courses that feed into their particular course. These summaries were submitted to the chair and copied and distributed to all faculty. They were subsequently

discussed at a departmental faculty meeting at the beginning of the next term, so that any necessary adjustments could be made to the courses for the next cycle of classes. All suggestions and changes then get documented in faculty meeting minutes as well as the course summaries each term.

How are we doing?

EC2000 has brought an awareness of the importance student learning the engineering programs. It is no longer sufficient to demonstrate that we are presenting the appropriate topics in our courses. We must be able to assess whether the students are learning the material. I believe this is a positive step for engineering education. Assessing the students' learning enables us to make adjustments where necessary to improve the quality of the teaching/learning experience. In our program at Toledo, employer surveys noted a weakness in our students' verbal skills in the interviewing process. We have instituted a Professional Development class for our first-year students in which we work on resumes, mock interviews and oral presentations to prepare the students for co-op experiences (we have a mandatory co-op program). Since the establishment of this course, our students' performance is much improved according the employer surveys. This is one example of assessing student performance, making a change, and reassessing the performance to evaluate the effect of the change. Without the pressure of EC2000, I doubt whether this change would have occurred as quickly as it did. So, I believe EC2000 is fulfilling its intended purpose, but there is much inertia involved in fully implementing the process. Buy-in by the faculty is a critical component that frequently seems to be a weak link. EC2000 can and does work very well as long as all constituents are actively involved. Another area of weakness is "closing the loop". Too often, copious amounts of data are collected but little is done with the analysis and evaluation. In order to make positive changes to improve the program, much work is involved in making sense of the data. It must be processed into a useful format for use by the program constituents. The faculty plays a key role in this analysis of the assessment data. They are the individuals that are closest to the program details.

In summary, if you take only one thing away from this discussion, effective faculty involvement and proper documentation are essential for demonstrating to a Program Evaluator that you have a fully functioning EC2000 process in your department.

Biographical Information

STEVEN LEBLANC is Professor and Chairman of Chemical and Environmental Engineering at the University of Toledo. He has been on the faculty since 1980 and department chairman since 1993. He has been involved in four ABET visits as a faculty or chairman, and as an EC2000 evaluator for three visits.