

EC 2000 Round Two – The Arkansas Experience

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Abstract

The ABET engineering accreditation criteria¹, popularly referred to as EC 2000, were first applied experimentally in 1996. The University of Arkansas was one of two schools whose programs were evaluated that year under these criteria. This past year (2002) the University of Arkansas became one of the first programs to be revisited under these criteria. This paper discusses the visit preparation and experience from the perspective of the civil engineering department head. The department head's experiences are unique not only because this was one of the first return visits under EC 2000 but also because he is responsible for two Master's degree programs that were reviewed for advanced level accreditation. The Master of Science in Transportation Engineering had been accredited following the 1996 visit. The Master of Science in Environmental Engineering was evaluated for the first time with the 2002 visit.

Introduction

In the United States, engineering academic programs receive their accreditation from the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (EAC of ABET, generally referred to as ABET). Until 1996 the accreditation criteria were a generally proscriptive listing of specific course, curriculum, facility, and faculty requirements. Many referred to the accreditation process as being one of "bean counting." There was a growing dissatisfaction with the process with many believing that it forced all programs to have the same "beans" and did not allow the innovation needed for engineering education to evolve and improve. As a remedy to this situation, a set of outcomes based criteria were proposed. These were used experimentally for the first time in 1996. These criteria were referred to as Criteria 2000, now more commonly called EC 2000².

These outcomes based criteria provide a broad description of the abilities an engineering graduate should have but leave the institution largely free to decide how it will instill these abilities. They require that the program set its own educational objectives and establish a process to determine how well the objectives are being met. The program is also expected to provide a means for improvement. In this respect, EC 2000 requires a continuous improvement process that must by its nature involve the faculty, the students and the employers of the program's graduates.

The University of Arkansas, College of Engineering was one of two schools that agreed to be evaluated under these criteria for the first time in 1996. That first EC 2000 visit was without question a venture into the unknown. No one knew for sure what we were to do. The final decision on whether or not we would be reviewed under the experimental criteria was not made

¹ The criteria can be found on the internet at: <http://www.abet.org/criteria.html>

² It should be noted that the designation EC 2000 is no longer technically correct. The "2000" has been dropped and the correct name is simply ABET Engineering Criteria. Nevertheless, EC 2000 is used in this paper for clarity.

until March or April. As a result we prepared all the ABET visit documents for the normal “bean counting” visit. Then in May we began preparing for the EC 2000 visit. However, there were no EC 2000 forms and there were no trained EC 2000 visitors. Consequently, we worked very closely with the visitors in preparing documents for the visit; and, I believe, because of the experimental nature, the visitors gave us a lot of latitude.

Obviously, because the criteria were new and the evaluation procedures were largely undefined, we could not be expected to have a very sophisticated process for outcomes assessment. However as 2002 and our next accreditation visit approached we became increasingly concerned about what would be expected from us as the first to go through the process the second time. This is the story of what we did and how we believe it turned out. The bottom line is the story has a happy ending.

Preparation and Involvement

My first experience with accreditation was in 1984 as a new faculty member. That fall we had an ABET visit. My only involvement was in being interviewed by the visitor. I had no other input to the proceedings and knew practically nothing about the accreditation process or criteria. My second experience was six years later, 1990. Quite frankly, my participation was not really much more than it had been in 1984. I did prepare notebooks for the courses I taught; but, other than that, most of the work was done by the department head. In fact it seemed as if accreditation was a once every six year event that required a lot of work by the department head. I became department head in 1991. At that point I became more concerned about accreditation but my view of the process did not change much. The only difference was that now I was responsible for that once every six year work load.

With EC 2000 and our 1996 visit all of that changed very dramatically. It quickly became quite obvious that many people needed to be involved and that accreditation concerns needed to be continuous. We began preparing for our 2002 visit in 1996 right after our visit. My first action was to get the faculty involved by appointing a curriculum review committee. The next year I asked our external advisory committee to review and critique our program and curriculum. We also began formulating improved assessment and documentation tools. Our objective was to be prepared for the next ABET visit and to do so in a way that would be effective without being overly burdensome.

Our Assessment Program

In 1999 a special external advisory group was formed. The chair of this group was a retired senior vice president from industry who had headed two efforts for his company that resulted in winning Baldwin Awards. Other members included the mayor of an Arkansas city who had previously been vice president of a major Arkansas consulting firm, the Vice-President of Building Design & Site Development for a major international corporation, a design engineer from a consulting firm, and an architectural engineering department head from another university.

This group was asked to give a totally independent look at our program and our processes. After gaining familiarization with EC 2000 criteria and reviewing our program, the group determined that they would be of most value to us by focusing on our assessment processes. By that time we

had most of our assessment processes in place. Nevertheless their review resulted in many suggestions for improvement. Most of the suggestions required relatively minor changes but these changes resulted in significant improvement in the quality of the assessment. Most significantly, they helped us establish more specific feedback mechanisms.

Components of Our Assessment Plan	
Student Course Assessments – each semester	
	Ratings on accomplishing course objectives
	Ratings relative to ABET outcomes
	Student comments to instructor
	University-wide course evaluation
Senior Exit Interviews – each semester	
	Identification of 3 best courses with factors making them best
	Identification of 3 courses needing improvement with recommendations
	Identification of 3 instructors with factors making them best
	Identification of 3 instructors needing improvement with recommendations
	Faculty ratings
	Rating of program relative to ABET outcomes
FE Exam Results	
	Program related topics only, comparison with national averages
Alumni and Employer Survey - annual	
	Graduates from 1 and 3 years previous
	Alumni feedback relative to:
	ABET outcomes
	Educational Comparison
	Job, salary, and graduate school data
	Comments requested
	Employer survey – immediate supervisor
	Educational comparison
	Comments requested
Faculty Assessment	
	University-wide course evaluation
	Student feedback on accomplishing course objectives
	Exit interview faculty evaluation
	Faculty productivity data
Strategic & Annual Plan with progress to date	

Our assessment process (summarized in the table above) involves students, alumni, employers and faculty. At the end of each semester, the students rate how well the course objectives were met and how effectively the ABET Criterion 3, a through k outcomes were addressed. (Obviously no one course addresses all eleven outcomes, but this assessment gives us an indication of where the students see the outcomes as being addressed and how well.) We also use a graduating senior exit interview that includes faculty evaluations and identification of

outstanding courses and courses needing improvement. The exit interviews also include a rating of how effectively the program as a whole is addressing the ABET Criterion 3 outcomes.

Our program assessment also includes tracking our students' performance on the Fundamentals of Engineering Exam. We do not use the pass rate. Rather we have identified those topics on the exam that are significant to our program. For each topic, we compare our students' average topic scores to the average scores for all civil engineering students taking the exam.

Relative to alumni and their employers, we send survey forms each year to alumni who graduated one and three years prior (i.e. in 2002 we sent the survey to graduates of 2001 and 1999). Each graduate receives two forms, one for the graduate to complete and one to be given to his/her immediate supervisor. The alumni survey form addresses the ABET Criterion 3 outcomes and asks the graduate to how well he/she was prepared for the profession in comparison with graduates from other universities. The employer survey only involves a comparative assessment of our graduates relative to those from other programs. Other pertinent information is requested on the alumni survey forms and both forms provide room for specific comments and recommendations.

The faculty assessment consists of the course assessments from the students, the senior exit interview assessments, and a performance/productivity assessment. The performance/productivity assessment is largely based on data supplied by each faculty member. These data are used in a formalized scoring system that produces productivity scores in the areas of teaching, research and service. Each faculty member receives a listing of everyone's scores but with only his/her own identified.

Documentation, Feedback, and Closing the Loop

Although the assessment process is important, it is not as important as what is done with the results of the assessment. These results must be communicated to the faculty and actions must be taken based on the results. Also, the entire process must be documented – the assessment, the assessment results, actions taken in response to the results, and any indication of the effect of those actions. In other words, we must “close the loop.”

The strongest negative comment that we received from our 1996 visit was that we were doing a poor job of documenting improvements we were making as a result of feedback from our constituents. Our visitor was convinced that we listened to our constituents and modified our courses and program based on what we heard. He noted that from talking with faculty he could tell that they frequently modified their courses in response to feedback from students, alumni, and employers; but, he found no documentation demonstrating that this was done or why it was done. We could show him changes we had made to the curriculum but we had no documents detailing why we had made those changes. Because of this comment we devoted a lot of thought on how to best document our improvements without creating a lot of work.

My first concern was how to document the numerous little changes that faculty members frequently make to their courses. Major program changes are relatively easy to identify and document; however, the little changes are much harder to track and document. What we came up with is both effective and simple and does not require much time. We developed a one page

course modification report. Once a year each faculty member completes a one page report for each class taught during the year. The report asks four questions: What did you do different in the course this year? Why did you do it? What effect did it have? What do you plan for the future? They complete this report as a part of their annual performance/productivity report. We maintain a file of these annual reports for each course.

Most of the rest of our feedback and documentation is handled in conjunction with our departmental faculty meetings. Each year, just before the start of school, we hold a two day faculty meeting with one day devoted to discussion of assessment data and other ABET issues. I prepare two reports for this meeting. One is a report of the results from our annual alumni/employer surveys and the other is a memorandum report of the senior exit interview data and comments. Following the meeting, a section is added to the alumni/employer report on actions taken in response to the survey and interviews.

We also have a departmental strategic plan. The strategic plan is also discussed at this two day meeting and an annual plan is adopted. During this same faculty meeting the other components of our assessment process are discussed. These include our tracking of FE exam results, progress relative to our strategic plan, student course assessments, and senior exit interview results. These discussions and any actions resulting from them are documented in the faculty meeting minutes. Feedback from the faculty performance/productivity assessment takes place during the spring semester on an individual faculty basis.

Advanced Level Program Challenges

The accreditation process for the two advanced level programs (MS degrees) presented some special challenges and concerns. One challenge/concern came from the fact that these programs are small and have few graduates. Although the MSTE (transportation engineering) degree received accreditation following the 1996 visit, we had a total of only seven graduates by 2000 when we conducted our first alumni/employer survey and there were only two additional graduates by the 2002 visit. The MSEN (environmental engineering) degree has a much longer history but the program requirements were completely revised after the decision was made to seek accreditation. When the first alumni/employer survey was conducted there were no graduates from revised MSEN program.

Because of this only one alumni/employer survey was conducted for these two programs. All MSTE graduates were surveyed. For the MSEN program, we surveyed recent graduates who had received either the MSEN as previously formulated or the MSCE with an environmental emphasis.

With such small numbers you may be questioning how these programs can be viable. Quite frankly, as stand alone programs they are not. However, these programs piggy-back nicely onto the transportation and environmental emphasis areas of our MSCE program. Consequently the MSTE and MSEN programs do not require special classes. All of the classes taken by the MSTE and MSEN students would be offered whether or not these two programs exist. In effect these programs generate a few additional students for us while providing a special opportunity for graduates of non-engineering programs who would like to be an engineer.

Yes, both programs are designed to accept students who do not already possess an engineering degree. This, in fact, is the source of another challenge/concern. The accreditation requirements for advanced level (graduate degree) programs are not very clear. They essentially state that the advanced level program must meet the requirements for basic level (undergraduate) accreditation and require one year of additional study. Obviously one easy way to meet this is to require the students admitted to the program to have an ABET accredited engineering degree; but, this would defeat our objective in seeking accreditation which was to open engineering opportunities for graduates of programs other than engineering.

You can (and must) take a “bean counting” approach to assure that the students complete the required minimum number of engineering, mathematics, and science courses (Criterion 4 Professional Component). The challenge and our greatest concern related to the Criterion 3, a through k outcomes (“Engineering programs must demonstrate that their graduate have:”). With only a few graduates and with some students completing mostly graduate level engineering courses, how do you assess and demonstrate how well the graduates are meeting these outcome requirements?

We took the approach that this situation is similar to the acceptance of transfer students. In the case of transfer students, transcripts must be evaluated and judged for acceptability. In this case students themselves must be evaluated and judged. We placed the responsibility for making the evaluation with the student’s graduate advisor and graduate study committee. The advisor and committee must evaluate the student’s abilities relative to each ABET outcome and must identify the evidence used as a basis for the evaluation. If significant weaknesses are noted in any area, the committee can mandate remedial action to strengthen the student’s abilities. We developed a form that the committee is to use to document the formal evaluation and evidence. The formal evaluation generally takes place during the student’s degree defense; but, the evaluation of abilities must be kept in mind throughout the student’s tenure in the program.

This concern was also alleviated somewhat by the fact that the non-engineering student must complete a large number of undergraduate pre-requisite courses and that these are completed within our college. This results in a close tie between these students and our undergraduate program. Because of this closeness, we contend that the outcomes from our BSCE program assessments are generally reflective of the outcomes we would expect from the two graduate programs.

We also had some concern over the fact that both graduate programs involve faculty from other departments. The MSTE program includes professors from Industrial Engineering and the MSEN program includes faculty from Chemical, Mechanical, and Biological Engineering. We hold at least one faculty meeting each year to discuss program issues. However, to date, neither program has had a student whose studies were primarily in one of the other departments or under a faculty member from one of those departments. Both visitors meet with the involved faculty from the other departments and they were both satisfied that this was not a negative issue.

Our Last Minute Preparation

With EC 2000 there really is no such thing as last minute preparation. If you are not preparing all along (and I mean every year between visits), you will not be prepared for the visit. However, there are things that we did just before the visit to be ready.

I wanted to make sure that everyone knew our program objectives. I asked the faculty to discuss the objectives in class. They were to discuss how they were established and how they had been reviewed periodically. We posted the objectives in the student study lounge. Then, just before the visit, most of us gave a pop quiz on the objectives. I also asked the faculty to discuss the visit with the students emphasizing its importance to them as well as to us.

We also had a couple of extra faculty meetings just to discuss the visit. We typically have only four or five faculty meetings per year. I always include some discussion of ABET or issues related to ABET. In this way our faculty members are well aware of accreditation issues. Nevertheless, we had the extra meetings just to make sure we all knew what we were doing.

2002 Accreditation Visit

Because the department had three programs under review, we had three program visitors, one for the BSCE program, one for the MSTE, and one for the MSEN E. All three visitors were very thorough and very professional. They were also very well prepared and came armed with good questions. Having three visitors presented a few scheduling difficulties particularly for me as department head. In addition to being department head, I am also the coordinator for the MSTE program. However, another faculty member serves as coordinator for the MSEN E program. Consequently we staggered the department head and visitor meetings and the MSEN E program coordinator sat in for me on some of the meetings with that visitor. For the most part, the three visitors met with faculty and students independently. However, we did schedule two combined student meetings. One was the meeting with our ASCE and Chi Epsilon officers and the other was the meeting with our senior design class.

I went into the visit pretty confident relative to the BSCE program; but as discussed above, I had some concerns relative to the two advanced level programs. Not surprisingly, the visitors for these two programs focused parts of their visits on these very issues.

One major issue arose during the visit that I have not mentioned before. It was a concern going into the visit and I was not surprised when it came up. This was a "bean counting" issue relative to the minimum number of engineering topics required in the MSEN E program. Recall that an advanced level program must meet the basic level program criteria and require one additional year of study. The basic level requires one and one-half year (or 48 semester hours) of engineering topics. The question was how many total hours of engineering topics are necessary for the advanced level.

This was not an issue with the MSTE degree because we covered the basic level 48 hours as a prerequisite requirement. For this degree, the non-engineering student must complete a minimum of 48 hours of engineering topics as a prerequisite to the graduate studies. However, a different approach was taken for the MSEN E degree. The entire course of study (undergraduate and graduate) is more closely defined than it is for the MSTE. The MSEN E is strongly science based and was designed as an integrated undergraduate/graduate degree. An outstanding undergraduate

can begin completing graduate course requirements after as few as 72 hours of undergraduate credit. Depending on the electives selected, the student can complete the degree with as few as 56 hours of engineering topics although a more realistic minimum is 62 hours.

The basic level 48 hour engineering topic requirement was an issue that concerned me when the revised MSEN requirements were first proposed. (I am not an environmental engineer so I was not involved in the initial formulation of the program.) I had interpreted the basic level as a prerequisite. The environmental faculty interpreted it as an integrated requirement; and, one of them (our program coordinator) had been a member of the American Academy of Environmental Engineers committee that established the program criteria for environmental engineering.

Because of my concern and our differences in interpretation, we sought clarification from ABET several times and at several levels beginning in 1998. We received replies to all of our inquiries but no one had a definitive answer. Because I was convinced that the program as developed was a solid engineering program and because no one at ABET could give us a clear interpretation, I agreed to adopt the program as proposed.

This issue was raised by the MSEN visitor the very first day. He discussed the issue at length with me and with our program coordinator. We both presented our interpretation of the requirement and told him how we had repeatedly tried to get a clarification since 1998. Fortunately we had copies of our inquiries and the replies (documentation) which we were able to give him. I also discussed the issue with the team chair. Both our visitor and the team chair called and discussed the issue several people in ABET and EAC. Ultimately it was decided that this was an issue ABET needed to address and clarify and that the lack of clarity should not affect the accreditation decision.

Visit Outcome

As you may know at the conclusion of the visit each visitor provides the institution a program audit form. This form lists the shortcomings of the program that the visitor has identified. These shortcomings are listed as “concerns”, “weaknesses” or “deficiencies.” This terminology is important.

A “deficiency” indicates that a criterion is not satisfied and that the situation must be corrected. The program will most likely receive an SC accreditation action (unless the problem is satisfactorily resolved prior to the action decision being made). This is the worst thing that can happen to an accredited program. SC stands for “show cause.” The “deficiency” must be corrected or the program could lose its accreditation following a subsequent visit. A program seeking accreditation cannot be accredited with a “deficiency.”

A “weakness” indicates that a criterion is satisfied but not to the level desired. Some remedial action is required and the accreditation action likely is an IV or an IR. These stand for interim visit and interim report respectively. In other words, the program can expect to have another visit or to prepare another report sometime over the next one to three years.

A “concern” indicates that the criterion is satisfied but the visitor foresees a possibility that a change will occur in the near future such that it is not satisfied. Action is needed to ensure that

full compliance with the criterion is satisfied. However, the program is likely to receive an NGR accreditation action. NGR stands for next general review. This is the good news and typically means that the next ABET visit will be six years in the future.

The outcome of our visit was almost as perfect as you could imagine. For the BSCE and MSEN programs the institutional audit forms listed no “deficiency”, no “weakness” and no “concern.” So we feel very confident that we should receive an NGR for these two programs. The audit form for the MSTE did show one “weakness” and two “concerns.” The “weakness” is an item related to how we assure that students without an engineering degree have a culminating design experience. We believe that can be corrected very easily well before the accreditation decision is made. The two “concerns” should not impact the decision and they reflect concerns that we have as well. Consequently, we also expect to receive an NGR for this program.

Closing Thoughts and Recommendations

The most important thing to recognize about the current ABET accreditation process is that it is a continuous process. You cannot wait and prepare for the visit the year before it occurs. If you are not already preparing, regardless of when your next visit is, you are already late.

The second most important thing is to recognize that the process must involve everyone, faculty, students, alumni, and employers. Most importantly, all faculty members need to be involved and involved continuously. We make ABET a part of every faculty meeting. ABET may not be mentioned in the agenda but there is always some item of discussion relating to what we can do to improve our program. There is always discussion of some of our assessment results.

Be sure to get students involved. Listen to them. Get their feedback. Make absolutely sure they are aware of what you are doing and why. Reinforce this awareness just before the visit so that the visitor can easily discern that the students are aware of the process, its importance, and that they have had input.

When it comes to assessment, don't forget that assessment is not the objective. The objective is program improvement. For this to occur, you must have feedback and actions resulting from the assessment. You must be able to show not only your assessment results but also changes and improvements made to your program based on those results. You must “close the loop.”

Don't forget to document what you do. The ABET visitor needs to be able to see evidence. Our simple, one page, once a year course modification report provides a lot of evidence of actions taken to improve our courses based on feedback from students, alumni, and employers. Faculty meeting minutes are valuable and do not need to be extensive; but they do need to demonstrate that the assessments were discussed and actions were taken. Any report prepared from your assessments needs to include a section on actions taken as a result of the assessment. Also, get reports from your external advisory committees.

And finally, don't forget that it is your program that is accredited, not your university, not your college, and not your department. You are responsible for it. Do not sit back and rely on others to provide what you need to maintain or achieve accreditation. For our 1996 visit an alumni assessment was performed at the college level. These assessments were to be repeated. By 2000

they had not and I decided that our department would do its own alumni assessment independent of the college. Later, when the college did act, the dean was not pleased with me for this decision. However, in similar circumstances I would certainly make the same decision again.

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