ABET Accreditation Issues in International Education

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Abstract

ABET 2000 accreditation criteria have substantially changed the philosophy of establishing the equivalency of programs within engineering education, and in particular, equivalency between programs offered in different nations. Under the old (pre-2000) system, course equivalencies might be established by simply showing that the same textbook was used in each course. However, with the newer guidelines, the standard of accreditation is based on "outcomes assessment" and now includes many more "soft" measures than was previously the case. The procedure for establishing some equivalency for a student who spends a semester or longer abroad as part of an accredited US engineering program, is now more ambiguous.

In this paper, a review of the ABET 2000 criteria as they relate to international exchange agreements is given. In particular, a student who shows the independence and motivation to participate in a study abroad program actually strengthens the satisfaction of many of the softer ABET 2000 criteria by virtue of the demands he/she must meet in order to successfully complete the study abroad program.

I. Study Abroad in Engineering

The importance of international experience for US engineering professionals has never been greater and will likely continue to increase substantially in the years ahead. The old notion of domestic corporations has essentially vanished, and this is especially true as the size of the corporation increases. It is almost inconceivable that current US engineering graduates will not have very substantial interactions with foreign partners, or at least with foreign operations of their own companies, during their projected working lives. In fact, many of them will receive foreign assignments requiring them to relocate abroad for extended periods during their careers. Study Abroad programs during the educational years represent an outstanding opportunity to prepare students for the future.

Unfortunately, US engineering student participation in study abroad programs does not yet adequately reflect this new reality. There is plenty of blame to go around - corporations, despite

urgent needs for internationally capable professionals, have for the most part refused to significantly reward students for this experience during hiring. US engineering schools themselves have not instituted requirements for study abroad experience, and many schools still do not actively encourage or promote study abroad as an elective experience to their students. ABET does not directly reward or promote international components in engineering programs - to the contrary, many US engineering schools are concerned that sending students abroad to satisfy a portion of their degree requirements may instead create problems during re-accreditation efforts. Taken together, these attitudes may have dire consequences in the future since some nations, including much of the European Union, strongly support international experience for their engineering students. US engineering student participation in study abroad is currently approximately 2% (i.e., approximately 2% of engineering degree graduates ever participate in a study abroad program); in some EU nations, the number exceeds 50%.

However, despite our dismal performance as a nation in grasping the long-range importance of study abroad for engineering students, there are some encouraging signs. US engineering programs at most major universities now generally offer some form of study abroad and many schools (including the author's) have established official offices to promote and manage international programs. Student participation, while still small, has grown steadily in recent years. More and more US engineering students are satisfying some portion of their degree requirements during study abroad periods at foreign universities. While the percentage at most US schools is still small enough to have minimal impact on evaluation of the program for ABET accreditation purposes, this appears to be likely to change in the foreseeable future. The purpose of this paper is to present some issues involved with ABET accreditation of US engineering programs in which a growing percentage of students satisfy degree requirements abroad. In many cases, study abroad programs do not detract from the accreditation, but rather, due to their unique nature, can add significantly to the strengths of a US engineering program.

II. ABET and Foreign Accreditation

ABET[1,2,3,4] does not offer accreditation to foreign engineering programs (note that the American University in Cairo, Egypt - a branch campus of the American University in Washington, DC - is ABET-accredited through the home campus in the US). Thus, virtually all US engineering students who participate in exchange programs involving study at a foreign campus are studying at non-ABET-accredited schools. Nevertheless, most of these students receive credit towards graduation at the US home campus.

ABET does offer an evaluation of "substantial equivalency" to foreign institutions.[5] Although not a formal accreditation, the intent is to evaluate whether or not a foreign program is substantially equivalent to an ABET-accredited US program. This designation could be helpful in cases where the student attends such a program, but unfortunately relatively few foreign institutions are interested in this substantial equivalency. The effort and expense required to obtain evaluation and be found equivalent is similar or even greater than required in the US to achieve accreditation, and in the end no accreditation is given even if the program is found to be substantially equivalent.

If most nations had accreditation systems similar to ABET, and if the accreditation criteria in these nations were similar to those of ABET, and if ABET accreditation implied homogeneity of programs, then simple transfer of credit for Study Abroad would not be a problem. However, even within the US, under the flexibility of the ABET 2000 guidelines, programs which differ widely from each other may both be accredited by ABET. Thus, even students who transfer credits from one US campus to another do not necessarily meet the ABET criteria in effect at the home (receiving) campus. Looking abroad, many nations do not even have national accreditation systems. Among those that do, the standards vary widely and there is no general agreement. For example, the European Union (EU) represents perhaps the closest cooperative agreement among independent nations anywhere in the world, now even sharing a common currency. However, attempts to establish some commonality of engineering education program standards and even a multinational EU engineering education accreditation agency for member nations have been unsuccessful. If the nations within the EU are unable to agree among themselves on accreditation standards, the problem for US schools attempting to compare themselves with European partners is obvious. Similar problems exist in comparing programs in the US with other regions of the world, which are generally not as unified even as the EU.

III. ABET 2000 Guidelines

Under ABET 2000[1,2,3,4], engineering programs seeking accreditation must define the objectives of the program, define metrics for evaluating whether or not the objectives have been met, define procedures for collecting and analyzing data sufficient to establish the values of the metrics defined, and finally, show (using the metrics and accompanying data) that the objectives have, in fact, been met. In particular, many of the key components are summarized in "Criterion 3. Program Outcomes and Assessment" in the ABET Publication, **Criteria for Accrediting Engineering Programs**. In essence, engineering programs must demonstrate that their graduates have:

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs
(d) an ability to function on multi-disciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modem engineering tools necessary for engineering practice.

Each program must have an assessment process with documented results. Evidence must be given that the results are applied to the further development and improvement of the program. The assessment process must demonstrate that the outcomes important to the mission of the

institution and the objectives of the program, including those listed above, are being measured. Evidence that may be used includes, but is not limited to, the following: student portfolios, including design projects; nationally-normed subject content examinations; alumni surveys that document professional accomplishments and career development activities; employer surveys; and placement data of graduates.

In international exchange programs, participating students earn a portion of their degree requirements away from the home campus, and in particular, while attending a foreign campus. In some instances, US engineering schools have teamed up with a particular foreign partner engineering school to create substantially equal courses that may be taken on either campus. In these cases, many of the students participating in Study Abroad will attend the partner school and take courses that are more-or-less identical to those taught at the home campus. Therefore, if the course at the home campus has been approved as part of an ABET-accredited program, little if any further effort is required to show that the student who participates in Study Abroad has met the same standards as those who do not.

However, more commonly, US engineering schools send and receive small numbers of students from each of numerous foreign partner schools - student numbers that are far too small, and foreign partner numbers that are far too large, to justify attempts at creating identical courses. In these cases, each student's coursework must generally be evaluated independently. Normal ABET evaluation procedures for a US program require that representative work from several students at the top, middle, and bottom of each class be provided for two years' offerings of a given course. This is clearly impossible in most cases. For these small, ad-hoc exchange programs, there may be only one student from the US campus who takes a given course at a foreign campus. Thus, there remains a very difficult task for establishing that a student is meeting the ABET standards of his/her home campus while taking courses abroad.

IV. Lower-level and Upper-level Courses

US engineering students typically take courses which may be reasonably well-defined by groups depending on the level of the student. During the first year, most engineering students take similar fundamental courses regardless of the particular engineering discipline of the major - English, chemistry and/or physics, mathematics, an introductory computer course, and perhaps introductory engineering courses. This year has the most commonality but also the fewest number of Study Abroad participants (typically, none). In the second year, engineering students begin to take fundamental courses in their chosen major, but there is still substantial commonality from university to university within a given major - for example, the introductory course in electrical circuits is often very similar regardless of the university where it is taught. Thus, evaluating course equivalency for these students is typically quite straightforward. In the third year, the commonality between programs begins to diminish as students move into more advanced required courses and begin to select elective courses. This trend continues to grow through the fourth year and until graduation. Thus, in the upper-level courses, course equivalencies can be much more difficult to establish and in fact, in some cases, there won't be a course equivalent between a US program and a foreign partner. However, the necessity of establishing course equivalencies also is greatly diminished since most programs will readily accept elective courses provided that the level of instruction is appropriate for the credit sought

and the topic is appropriate for the major. In fact, Study Abroad often provides the student with an opportunity to take upper-level elective courses of high interest within his/her major that are not offered on the home campus.

These descriptions of course equivalencies at different levels of study are based on the standard US system of four years of undergraduate education, beginning immediately after high school graduation. However, few nations have similar standards for high school graduation and therefore the starting point for engineering study at "university level" may vary widely from nation to nation. In addition, the strong movement within the US to introduce more "design-oriented" courses earlier in the curriculum has not been universally embraced abroad, where the beginning years often still stress mathematics and basic sciences. Thus, for example, in France, which arguably has the highest selectivity of engineering students in the world, the first two years of study consist almost entirely of intensive mathematics and science. Only in the third year after high school does a student begin the "first year" of engineering study, and the courses are taught at a level of mathematical sophistication that is beyond the reach of most US students in the "first year." Establishing course equivalencies requires the home campus to educate itself about these kinds of distinctions which may not be obvious based on course titles and syllabi.

V. Course Data Bank

An innovative project is currently underway, organized by the Global Engineering Education Exchange (Global E3) program of the Institute for International Education. The Global E3 program includes more than 80 universities - approximately 30 from the US, and approximately 50 from a total of 14 nations outside of the US. The course data bank is compiling information from each of the US member schools regarding previous course equivalencies that have been granted to students. Virtually all of the US participant students have come from ABET-accredited programs. Therefore, if the home US campus accepted a course taken abroad in lieu of home campus requirements, then it has in effect endorsed the course as suitable within its program. By compiling the cumulative results of all 30-odd US member institutions, the goal is to create a large database that can easily be accessed to determine for a particular course taken abroad whether any ABET-accredited US member school within the program has previously accepted that course. This program should ease the burden on individual US campuses for determining these equivalencies, and at the same time, help to ensure quality by increasing the number of US students whose results in the course can be evaluated.

VI. Conclusions

In this paper, we have addressed some of the problems related to ABET accreditation of US engineering programs which allow students to earn some of their degree requirements during study abroad periods at foreign universities. The importance of study abroad within US engineering education seems likely to grow substantially during the foreseeable future. However, there are no internationally-agreed standards of engineering accreditation. Therefore, most US engineering students who study abroad do not do so at an ABET-accredited campus. While study abroad for US engineering students still does not enjoy high numbers of participants, it is very likely that it will grow substantially in size and importance during the foreseeable future. Issues related to accounting for foreign experiences in ABET accreditation

efforts at the sending US campus have been discussed, along with a number of current efforts to improve this process.

Bibliography

1. Policies and Procedures for ABET Substantial Equivalency Evaluations, Accreditation Board for Engineering and Technology, Inc., 1994.

2. Criteria for Accrediting Engineering Programs, Accreditation Board for Engineering and Technology, Inc., 2001-2002 accreditation cycle.

3. Accreditation Policy and Procedure Manual, Accreditation Board for Engineering and Technology, Inc., 2001-2002 accreditation cycle.

4. **Manual of Evaluation Procedure of the Engineering Accreditation Commission**, Accreditation Board for Engineering and Technology, Inc.

5. Kathryn B. Aberle, Demetrius T. Paris, and George D. Peterson , "Quality Assurance in International Engineering Education: A Summary of ABET Activities," Presented at the Conference: ***Trade Agreements, Higher Education, and the Emergence of Global Professions: The Quality Dimension***, May 9, 1996.

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