Standards-Based Assessment of Humanities/Social Science (H/SS) Programs in the Liberal Education Division (LED)

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For decades, curricula in the Humanities and Social Sciences (H/SS) for engineering students and faculty have been dominated by the now-displaced ABET “Conventional Criteria” which required that engineering students devote “one-half year [of study to the] humanities and social sciences” (“ABET Criteria for Accrediting Engineering Programs,” I.C.3.a.[2].) The “Conventional Criteria” went on at some length in I.C.3.d.(2) to justify this requirement in terms of:

a) arguing for the importance of H/SS to both engineering and general education;
b) “making engineers fully aware of their social responsibilities and [becoming] better able to consider related factors in the decision-making process”;
c) enjoining that such courses be selected to “provide both breadth and depth and not [be] limited to a selection of unrelated introductory courses”; and

d) defining both acceptable traditional H/SS areas of study (e.g., history, philosophy, economics, foreign languages), acceptable nontraditional subjects (“technology and human affairs, history of technology, and professional ethics and social responsibility”) as well as unacceptable courses (“courses that instill cultural values are acceptable while routine exercises of personal craft are not.”)

In short, the old “Conventional Criteria” not only mandated how much H/SS course work students had to pass but specified in some detail the breadth and depth of acceptable course areas for study.

The “Conventional Criteria” are no longer in force. Beginning in 2001, all programs seeking ABET accreditation must adhere to the new Engineering Criteria 2000 (EC2000) which offer much briefer guidance; the new Criterion 4c stipulates only “a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.”

The change is striking. EC2000 challenges engineering educators to make H/SS a relevant part of the mission of the engineering program rather than simply requiring students to pass classes. EC 2000 offers much greater latitude for experimentation for H/SS but removes the guarantee of a modest slice (a half year) of the four-year curriculum.

Experimentation with H/SS programming should—as EC2000 intends—encourage greater diversity for curricular planning and for demonstrating learning outcomes. Hopefully, some
institutions will invest resources in new approaches to H/SS, believing that program
differentiation may provide comparative advantages in attracting students. If such differentiation
succeeds, many stakeholders in engineering education will be interested in comparing the
learning outcomes of increasingly diverse H/SS programs established at different engineering
institutions.

Anticipating this increasing differentiation of H/SS programs, participants at the 2000
ASEE/LED meeting at St. Louis began discussing the pros and cons of reviewing, assessing, and
even ranking H/SS programs separately from the process of engineering program assessment. (A
broader issue of including all liberal education components—including mathematics and the
physical sciences—within such assessment was not addressed since mathematics and the
sciences usually get substantially more attention than H/SS in ABET reviews.)

This paper is intended to discuss some issues associated with trying to assess and rank H/SS
learning within undergraduate engineering education. I will try to cover four aspects of the
discussion:

1. The impact of the transition from the conventional ABET criteria to EC2000.
2. The advantages of standards-based assessment of H/SS within engineering education.
3. Establishing such standards.
4. Conducting and using an evaluation based on standards.

1. The impact of the transition from the conventional ABET criteria to EC2000.

A characteristic of engineering accreditation visits that appears unlikely to change greatly with
full-scale implementation of EC2000 is the virtual ignoring of liberal education (especially
H/SS) programs during an accreditation visit. Because ABET visits are aimed at program review
of individually-accredited departments, visitors are rarely assigned to review and assess
programs other than those specifically accredited. All other aspects of an institution’s pedagogy
are regarded as ancillary: visitors may or may not spend much time with the librarian, science
and mathematics department heads, or faculty in the humanities and social sciences.

Conversely, during a regional accreditation visit, where eight to twelve visitors are responsible
for every aspect of the educational program, the attention given specifically to liberal education
programs aimed at engineering students tends to be diffused among broader discussions of the
role of general education within the entire university. Only at technological universities where
the institutional mission is focused on science and engineering are visitors likely to attend to the
special concerns of presenting H/SS to engineering students. But all too often, especially at
larger institutions, H/SS and liberal education within engineering programs are very much lost in
the shuffle of other concerns during accreditation visits.

The outcomes assessment-based aims of EC2000 do not, in themselves, guarantee much
attention to or impact on liberal education. EC2000 requires that each institution and
engineering-oriented program within the institution define its own mission and goals statement, and that such programs contain “a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.” But in practical terms, the diffusion of interest during either an ABET or regional accreditation preparation or visit tends to reduce significantly the role of and attention to liberal education. At the 2000 ASEE Conference, this point was well illustrated when someone from LED asked at the large open meeting with the big ten engineering deans whether, as a result of their recent EC2000 visits, they had learned anything about the role of liberal education in their programs. The response of the panelists varied from laughter (nervous? guilty? indifferent?) to one dean stating that the visit had proved to be very helpful in terms of articulating problems engineering students had in the mathematics department, leading to a valuable discussion among the appropriate heads. This response illustrated the typical pragmatic response of engineering deans to liberal education in terms of their concern primarily with the direct and instrumental applications of liberal learning: mathematics as a tool for solving engineering problems.

Furthermore, the absence of any prescribed minimum of H/SS courses in the new EC2000 (in contrast to the half year mandated in the old guidelines) means that institutions can reduce their attention to the humanities and social sciences, perhaps even lowering or eliminating the number of courses required in the college of arts and sciences. The “general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives” can be defined in many ways—with or without including H/SS faculty as participants in the definition process. Indeed, at the 2000 ASEE Conference, several deans were noted using phrases like “spreading the soft skills across the curriculum.” By this they may well mean that those ABET Criterion 3 requirements dealing with non-technical skills might be embedded within engineering courses. Of the eleven outcomes of Criterion 3 listed below, the six in italics have traditionally been considered as “soft skills” in engineering education, perhaps because students can develop them as well in H/SS or other liberal arts areas as in engineering:

**Criterion 3. Program Outcomes and Assessment**

Engineering programs must demonstrate that their graduates have:

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

Revising the engineering curriculum to provide opportunities for students to achieve these “soft” outcomes in engineering courses is a challenging task, placing new expectations on the conventional engineering curriculum. Yet some engineering programs are moving in this direction—bringing the “soft skill” courses in H/SS into the engineering school itself. A considerable advantage of such a move is to eliminate the often politically and practically awkward reliance of engineering programs on courses taught in a different college. For example, at one major technological university, engineering departments are beginning to hire their own technical communications faculty and redesigning their courses to develop communications skills within the college of engineering—and no longer to depend on the college of arts and sciences. Similarly, engineering departments and colleges are increasingly hiring their own faculty to teach ethics; institutions with comprehensive first-year programs for prospective engineering majors are weaving the “soft skills” through the first year, sometimes the first two years.

“Spreading the soft skills across the curriculum” may have significant advantages for the engineering faculty and departments, and certainly can offer some pedagogical advantages to the students. But again, the direct utilitarian goals are the ones most likely to be achieved. Exposing engineering students to H/SS courses—and to other students—only in the engineering college will likely mean they have far fewer opportunities to study the humanities for their own sake as opposed to the pragmatic and utilitarian ends embodied in the phrase “soft skills.” I am not aware of any engineering department or college that has dedicated its own faculty lines to the teaching of Shakespeare, Plato, Mozart, or Rembrandt.

2. The advantages of standards-based assessment of H/SS within engineering education.

Securing greater attention and concern for humanities and social sciences through responding to the challenges of EC2000 will most likely fall, at least initially, to the kinds of faculty active in the LED. We must persuade our colleagues in engineering education that a carefully crafted approach to liberal education, especially in H/SS, is a way to establish a comparative advantage and thus a market niche for our programs and institutions. And humanities and especially social science faculty are often more predisposed towards and professionally competent at assessing student learning outcomes. Thus EC2000 offers opportunities to humanities and social science faculty to refocus and strengthen their programs within engineering institutions. To the degree that liberal education is differentiated within an engineering program as a significant asset in the preparation of students, and is assessed accordingly, such engineering programs may have a distinct advantage in recruiting students over programs with less attention to liberal education.

Establishing standards for H/SS and assessing learning outcomes will be an advantage to H/SS faculty and ultimately to the pedagogy to engineering program. Assessing and reviewing the learning outcomes of humanities and social sciences within the engineering curriculum most
likely will occur through inter-mural discussions and visits of faculty, both in engineering and in humanities and social sciences, interested in these issues. Such external reviews would, as they do for the engineering curriculum itself, continue to focus attention and resources on the role of H/SS and provide opportunities for the exchange of ideas about best practices and successful programs. Reviewing the standards established at each institution for the role and outcomes of H/SS will help make the H/SS strand more successful within engineering education.

But this success will come only if H/SS faculty share in the institution-wide work of defining the EC2000 “general education component that complements the technical content of the curriculum” to include the right mix of learning opportunities for students to achieve the appropriate H/SS outcomes. And of course H/SS faculty, like all others, must ensure that the data gathered and assessment performed result in overall curricular and learning improvement.

3. Establishing standards for H/SS studies within engineering programs.

If the argument is accepted that H/SS programs would profit from external assessment visits, the next issue requiring discussion is how would the pedagogical standards for such programs be established. Several options present themselves.

The standards might be established separately by each institution, as implied by EC2000 itself with its invitation to each accreditable program to find their own goals, missions, educational outcomes, and the like. Individual schools, departments or even programs could establish their own standards and outcomes. The standards might also derive directly from institution’s general education requirements.

Needless to say, each of these approaches has strengths and weaknesses. Establishing standards and outcomes at the level of actual local practice within the faculties closest to the policies and realities of teaching is clearly important. But it seems to me that H/SS standards need in some way to combine the authority of the regional or national accrediting agency with the particular practices derived from the mission and goals of the individual institutions. Not to combine these two--local and regional/national--is to risk creating standards that are either unique to the institution (and thus not susceptible of comparisons to promote improvement) or so broad as to occlude the very differentiation EC2000 seeks to promote. On the one hand, internal standards that are entirely homegrown will inevitably value those things the institution does well and possibly ignore those it succeeds less well with. Assessing the resulting outcomes will at best validate only those strengths locally deemed most salient. On the other hand, external standards that ignore local strengths will fail to reward thoughtful local experimentation. EC2000 will not profit H/SS if assessment reverts to the now-superseded ABET practice of assuring that an institution is meeting only the lowest common denominator for H/SS studies.

Two external standards are available to engineering programs—EC2000 and those embodied within their regional accreditation authority. The outcomes expected of Criterion (Standard, if you like) 3 of ABET are quoted above. If anything, they are excessively broad and offer much
room for local interpretation. I propose that, given this latitude of interpretation, that institutions or programs seeking H/SS standards and outcomes combine the broad mandate of EC2000 Criterion 3 with the usually more specific standards of their regional accreditation agency.

Below are the relevant five sections from Standard Four, “Programs of Study,” for the New England Association of Schools and Colleges (NEASC), the regional accreditation association to which my institution (WPI) belongs. I have italicized sections that I will discuss briefly following these NEASC texts.

4.15 *The general education requirement is coherent and substantive, and it embodies the institution’s definition of an educated person.* The requirement informs the design of all general education courses, and provides criteria for its evaluation.

4.16 The general education requirement in each undergraduate program – general specialized, or professional – ensures adequate breadth for all degree-seeking students by showing a balanced regard for what are traditionally referred to as the arts and humanities; the sciences including mathematics; and the social sciences. General education requirements include offerings that focus on the subject matter and methodologies of these three primary domains of knowledge as well as on their relationships to one another.

4.17 The institution ensures that all undergraduate students complete one-third of their studies (or the equivalent of forty semester hours in a bachelor’s degree program, or the equivalent of twenty semester hours in an associate’s degree program) in general education. If the institution offers any program which does not include at least one-third of its requirements in general education, it is able to demonstrate that the program meets the goals expressed in Paragraph 4.19 of this Standard. *In no case, however, does the general education component of an undergraduate program constitute less than one-quarter of its degree requirements (or the equivalent of thirty semester hours in a bachelor’s degree program, or the equivalent of fifteen semester hours in an associate’s degree program).*

4.18 The major or area of concentration affords the student the opportunity to develop knowledge and skills in a specific disciplinary or interdisciplinary area above the introductory level, through properly sequenced course work. Requirements for the major or area of concentration are based upon clearly defined and articulated learning objectives, including a mastery of the knowledge, methods, and theories pertinent to a particular area of inquiry. Through the major or area of concentration, the student develops an understanding of the complex structure of knowledge germane to an area of inquiry and its interrelatedness to other areas of inquiry. *For programs designed to provide professional training, an effective relationship exists between curricular content and current practice in the field of specialization.* General studies associate’s degree programs designed to provide the foundation for later specialization through transfer into baccalaureate programs are exempted from the requirements of this paragraph.
4.19  Graduates successfully completing an undergraduate program demonstrate competence in written and oral communication in English; the ability for scientific and quantitative reasoning, for critical analysis and logical thinking; and the capability for continuing learning. They also demonstrate knowledge and understanding of scientific, historical, and social phenomena, and a knowledge and appreciation of the aesthetic and ethical dimensions of humankind. In addition, graduates demonstrate an in-depth understanding of an area of knowledge or practice and of its interrelatedness with other areas.

Institution-specific standards for H/SS learning outcomes based on these NEASC Standards combined with EC2000 can be sketched briefly as follows:

4.15 An H/SS curriculum should characterize carefully how the outcomes of H/SS studies at a given institution “embod[y] the institution’s definition of an educated person.” This embodiment should link readily to EC2000’s “general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.”

4.16 Similarly, the H/SS standards should clearly relate to any university-wide general education requirements. Such requirements very likely will include expectations for serious study of mathematics and the sciences as well as the humanities and social sciences. H/SS standards should thus correlate to mathematics and science as well as history, literature, the arts, and the social sciences.

4.17 The NEASC language here is crucial. Even though EC2000 no longer mandates a minimum defined in terms of a portion of the two- or four-year curriculum being devoted to “general education” (of which the constituents of H/SS are an important part), NEASC, like most regional accreditation agencies, does have such a requirement. Anyone advocating “spreading the soft skills across the curriculum” as a way of bringing H/SS within the school of engineering will have to convince regional accreditation visitors that the full import of this standard is met within the school of engineering.

4.18 H/SS courses and especially projects may well be excellent vehicles for linking curricular theory and contemporary practice together, especially in terms of providing students with opportunities to learn about the important (but often difficult to teach) EC2000 Criterion 4 (“Professional Component”) “considerations: economic; environmental; sustainability; manufacturability; ethical; health and safety; social; and political.”

4.19 For NEASC, this final standard articulates in detail all the liberal arts areas of study that must be addressed for regional accreditation. Clearly if the EC 2000 “soft skills” are focused only on such instrumental outcomes as communications, meeting these broader regional accreditation standards will be very difficult. The H/SS standards must therefore look carefully at regional accreditation requirements to ensure that the broader cultural, esthetic and humanistic components of a liberal education are embraced.
While I have not reviewed the corresponding language on the liberal arts/general education requirements in the other regional accrediting associations, I believe that because the general education component is so highly valued nationally, LED members are likely to find valuable guidance in framing a set of balanced H/SS standards in their own regional standards.

4. Conducting and using an evaluation based on standards.

Developing standards to enhance student learning skills in H/SS will require resources focused on both recruiting faculty willing to undertake the necessary tasks and on identifying a larger set of stakeholders interested in their results. Discussions, admittedly on the fly at the 2000 ASEE meeting, disclosed little support from engineering deans for adding yet another member to an ABET accrediting team to look at the implementation of H/SS programs during a conventional ABET visit. Most likely then, advocacy for establishing H/SS standards will come mainly from faculty with a continuing interest in H/SS issues. The Liberal Education Division of ASEE provides a working space for faculty from many disciplines who share the kinds of experiences and interests needed to promulgate H/SS standards. A readily-available way to get started with designing a system to conduct and use H/SS standards is to devote one or more sessions of the annual LED ASEE program to framing and conducting this initiative.

Given the realities of budget and time, it seems unlikely that either the ABET or regional accreditation process will add a component dealing specifically with H/SS standards. As a possible alternative, faculty meeting at least annually through the ASEE/LED meetings could both design an inter-mural H/SS set of standards and perhaps even conduct reviews at the ASEE/LED venue. Such standards and reviews should, as I have argued, be informed fully by both EC2000 and the relevant regional accreditation standards. Further, just as the H/SS standards should draw upon both the internal strengths of each program as well as the external ABET and regional standards, reviews of H/SS outcomes should look both at the data on student performance from each individual institution and at any cross-institutional data such as those available from the EBI and NSSE-AITU surveys. (The Educational Benchmark-EBI survey is administered to fourth-year graduating engineering seniors. The NSSE-AITU survey has been devised by a consortium of nine members of the Association of Independent Technological Universities who are administering to second-semester first- and fourth-year students the standard National Survey of Student Engagement instrument with 19 additional questions bearing on the EC2000 expected outcomes for a technological education.)

Above all, establishing H/SS standards will take persistence and patience. The education community (industry?) has by no means universally embraced standards-based outcomes assessment. H/SS education remains on the margin of attention within engineering education. Only if H/SS faculty argue successfully for the substantive inclusion of H/SS learning outcomes within the mission and goals of their own engineering programs will this marginalization change. This argument must overcome the subtle danger lurking in the embracing of the “soft skills” of EC2000 as the consensus justification for liberal education within engineering education. The
phrase itself reeks of “second class citizenship,” embodying as it does only the utilitarian justification for H/SS. The intellectual and critical thinking skills grounded in the humanities and in general and liberal education should be a salient part of what any institution wishes (in the words of NEASC standard 4.15) to impart as its “definition of an educated person.”

Bibliography