WannABET? Historical and Organizational Perspectives on Governance in Engineering Education

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Abstract

The recent round of proposed changes to the ABET engineering accreditation criteria has drawn significant attention from the engineering education community. After two decades of alignment between ABET learning outcomes and the stated priorities of the profession as articulated in documents such as *Educating the Engineer of 2020, Changing the Conversation*, the American Society of Mechanical Engineering’s (ASME) *Vision 2030*, and the American Society for Civil Engineering’s (ASCE) *Raising the Bar*, many have struggled to identify the reasons behind ABET’s apparent intent to depart from the ideal of a liberally educated engineer that they themselves were instrumental in creating. Here we employ organizational theory and historical analysis to help explain ABET’s actions.

How have the broader politics of accreditation and higher education governance shaped ABET’s goals and operations? How have changes in accreditation standards and their associated change processes shaped the structure and value commitments of the profession? How do engineering mindsets and corporate cultures shape engineering ontologies and epistemologies of assessment and approaches to governance? How do global neoliberal trends in and beyond higher education shape institutional values and cultures, and how are these embodied in assessment and governance practices? Through historical and organizational analysis we seek to trace changes in the governance structures of engineering education and accreditation, and the impacts of the development and employment of accreditation in higher education.

In this paper, we will first provide a brief historical perspective on accreditation processes and organizations in engineering education, with a view to governance structures. Then we offer a more in depth comparison of ABET’s development of Engineering Criteria 2000 (EC 2000) with the current proposed revisions as they have unfolded. We seek to develop insights on the role of governance in effecting change in engineering education, and specifically on historical changes in ABET’s processes for decision making and theories of change. These insights will point to possible interventions in governance structures to facilitate more inclusive participation in setting future directions for engineering education.

Introduction

ABET, Inc.’s proposed changes to Criteria 3 and 5 of the Engineering Accreditation Criteria, now in their third round of review and comment, continue to draw concern from the Engineering Education community as well as from other member professional societies, most notably the American Society of Civil Engineers. Criterion 3 covers the familiar “a-k” student learning outcomes in engineering, while Criterion 5 covers the overall structure of the curriculum (e.g., relative amounts of math and science, engineering fundamentals, and humanities and social science content). ABET’s seemingly abrupt departure from a common ideal of a liberally educated engineer—after two decades of alignment among ABET’s EC2000 “a-k” learning outcomes and goals articulated in numerous blue ribbon reports from the National Academies
and the professional societies\textsuperscript{2,5}—raises a number of questions.

The process has offered opportunities for both revelation and reflection. Here we consider the role of the American Society for Engineering Education (ASEE) within ABET, both in the present and historically, and examine how we came to inhabit our particular governance practices within our present organizational structure. Governance refers to the decision-making processes and procedures of an organization, formal and informal, official and unofficial. We are interested in how power is mediated among stakeholders in these processes, who is given voice, and what is revealed about the values and self-understanding of the profession throughout.

We employ organizational theory and historical analysis to trace the changes in governance structures in ABET and in the wider engineering education organizational ecosystem. We consider how the broader politics of accreditation and higher education governance have influenced ABET’s goals and operations, and how these in turn have shaped and been shaped by the structure and value commitments of the profession. How do engineering mindsets and corporate cultures shape engineering ontologies and epistemologies of assessment and our approaches to governance?

This paper seeks to examine how governance structures and procedures in engineering education gave rise to the current situation and identify changes that may be needed in order to have a more transparent, democratic, and responsive process for governing the formation of engineers. After providing background on governance and accreditation in higher education, we offer a brief historical perspective on accreditation processes and organizations in engineering education, followed by a comparison of the development of EC 2000 criteria against the current revision processes as they have unfolded. From this we develop insights on the role of governance in effecting change in engineering education, and point to possible interventions in governance structures to facilitate more inclusive participation in setting future directions for engineering education.

Recognizing the strong preference within the engineering education research community for empirical approaches, we note here the value of the organizational and historical theoretical-analytic and historical approaches taken here. In undertaking this work we have used primary and secondary historical sources and publicly available information from ABET and other organizations involved. We believe these sources and the analysis we bring to them offer significant opportunities to generate new knowledge and insights on recent events. While additional archival, interview, and participant observation data would certainly enrich this study, this will not be pursued in this paper.

**Governance and Accreditation**

The system of governance that exists to oversee the system of higher education and engineering education in the United States is layered and tremendously complex. The governance of universities extends well beyond policies and procedures put in place by the administrators of a single institution. Federal policies, congressional pressures, state systems of higher education, accreditation agencies, and professional organizations all contribute to how each engineering school and engineering program within universities operate their educational programs.
Congressional and presidential pressures on higher education work to regulate the national objectives with the outcomes and goals of individual universities. Pushed forward by President Lyndon Johnson, passage of The Higher Education Act (HEA) of 1965, worked "to strengthen the educational resources of our colleges and universities, and to provide financial assistance for students in postsecondary and higher education." Along with the resources afforded to public higher education came the expectation that public universities will be held at a certain quality and thusly need to be a part of a larger educational accreditation system; a system which maintains that each university is at the required set of standards to receive federal support.

Shifts within higher education, brought about by the passage of the HEA in 1965, facilitated the embedded role of accreditors within the educational system through the notion that accreditation in the United States equated to quality assurance and quality improvement. Within the system of educational accreditation, there are two basic types: institutional and programmatic. Institutional accreditation, conducted by regional and national accreditors, is granted through evidence that the entire institution is contributing to the overall achievements of the institutional goals. Programmatic accreditation, on the other hand, can apply to schools, departments, or programs that are part of a larger educational institution.

According to the US Department of Education, there are specific roles that accreditation is expected to play within the educational system:  

1. Assess the quality of academic programs at institutions of higher education
2. Create a culture of continuous improvement of academic quality at colleges and universities and stimulate a general raising of standards among educational institutions
3. Involve faculty and staff comprehensively in institutional evaluation and planning
4. Establish criteria for professional certification and licensure and for upgrading courses offering such preparation

Accreditation in higher education is largely driven by the culture of standardization within the United States. Ideally, accreditation works as a mechanism to guarantee, to its various stakeholders, particular sets of quality standards at higher education institutions. In the United States, accreditation organizations are typically carried out by private and nonprofit organizations funded by the institutions and programs that undergo accreditation. The discourse between external regulations on quality assurance based on outcomes and the historical decision making process in education surrounding curricula yields a system based on coordination rather than unified/centralized decision making. Inevitably the interdependent process now seen in higher education can potentially lead to institutions receiving multiple or even mixed messages related to change.

**Quality Assurance/Standardization as a means of Governance Restriction**  
Salter and Tapper lay out the political landscape of governance in higher education, noting “the governance of higher education as an arena in which there is a continuing struggle for the control of high status knowledge through the functions of standard setting, evaluation and intervention” (p. 66). While recognizing the validity of accreditation as a means of ensuring standards of quality in higher education, accreditation is a complicated, expensive, and time-consuming
process. Burke and Butler\textsuperscript{13} raise two important questions as to how accreditation fits within the broader goals of higher education. First, how are students to discern if specific courses within an accredited institution or program constitute good education, and secondly is institutional and programmatic accreditation the best practice to assure educational quality. Essentially, do institutional and programmatic accreditations speak to specific standards of quality for individual courses student take? If the direct and clear answer is anything but a definitive yes, then we have reason to be considerably concerned given the resources we pour into accreditation, the level of confidence placed in accreditation, and the manner in which accreditation deeply shapes our graduates (and our future workforce).\textsuperscript{12,14}

Salter and Tapper also indicate that accreditation maintains a continuing power struggle over the control for regulatory power of knowledge and whereby, “accreditation and its quality assurance combines technical, bureaucratic and value elements in ways which give power to some and remove it from others”.\textsuperscript{12} By accepting a standardized set of criteria, universities lose autonomy in conceding to external pressures to demonstrate concordance with other universities of a similar status. Accountability mechanisms that are built into accreditation procedures place strong demands on universities to maintain conformity.\textsuperscript{14} Yet if the objective is to maintain homogeneity among academic programs to ensure educational standards and quality, how can university administrators structure their own policies and internal affairs to secure substantial conformance within their own institution and institutional contexts? Tensions and power struggles exist at every level.

**Relationship of ABET to Engineering and Engineering Education**

To understand the role of ABET in Engineering and Engineering Education, we must first understand the governance of ABET and their historical roots as an organization. ABET is not a monolithic organization, but a volunteer-based organization with multiple moving parts. The volunteer nature of ABET can potentially be problematic for the integration of diverse individuals who must participate in the review process in order to drive ABET’s accreditation of programs. The nature of volunteer-based labor with sporadic schedules to fulfil site visit requirements can minimize accessibility to junior members of the field; there is the risk that this can perpetuate more traditional perspectives on engineering than are found in the engineering education community at large, and this becomes an issue when strong training in professional skill sets are pitted against a more traditional technical competence. Here we are primarily interested in what a naturalized organization view can reveal about the recent proposed changes and the processes by which they were produced. Secondly we take an open-systems perspective to consider ABET’s interactions with the wider engineering education community throughout this process.

ABET is organized as a coalition of professional society members, and as such its actions are best understood through organizational theories that take either a naturalized organization perspective—one attentive to the actual functioning of an organization, as opposed to the role defined by its formal structure—as well as an open-systems perspective. The naturalized organization perspective allows us to also describe the competing interests that exist within an organization, while an open-systems perspective allows us to consider how an organization functions by working in a more porous way with influences from within the broader field it
occupies and from society at large. The public face of ABET presents us with a third view, however, namely a rational organization perspective, which posits the organization (and its broad representation of the engineering field) as acting from a singular, consistent, and rational perspective. The principles that guide rational systems--specific missions and objectives with an organization acting in unison--do not necessarily align with the current organizational structure of ABET any more than the complex governance structures that characterize higher education as a whole. We caution against viewing ABET as a rational, organizational actor due to the tensions we know to exist within engineering as a whole, and the independent goals articulated by ABET’s member organizations.

Still, the fact that ABET straddles a natural and open system design, while maintaining the outward face of a rational organization, affects how change can be enacted, whether originating from within the organization or as initiated by external constituents within the wider engineering community. As it is the function of accreditation to review and uphold standards of quality within education, there is no doubt that engineering programs look to ABET as a baseline of what is not only valued within the field but the standards expected of engineering degree programs and their graduates. ABET maintains a power dynamic over engineering programs based on its stipulations for program criteria; programs that do not adhere to ABET criteria will not be accredited. So the question loops to understanding what power the constituents have in their relationship with ABET, and how to understand that relationship to ensure that accreditation criteria encompasses what is valued among ABET’s constituents.

It is therefore problematic that ABET is perceived as being capable of acting autonomously, because the various voices of ABET’s constituents should be foundational to what becomes the criteria for accreditation. Essentially the various voices of constituents, in agreement with, or opposed to ABET’s actions, work as a means of checks and balances to ensure that the goals and objectives that become encoded into accreditation criteria are not imposed by any single administrative entity within the engineering profession. If criteria and accreditation changes are implemented within ABET, decision making should be maintained as a shared responsibility with formal inclusion from constituents at all levels of the change making process. As accreditation has the ability to enact organizational change within engineering education through its influence on the process by which we produce and educate engineers, transparency in the decision making that occurs is essential to ensure organizational accountability.

When examining the organizational structure of ABET it is worth noting important factors such as its hierarchical complexity and the existence of multiple boards and commissions including a Board of Directors (which undertakes the fiscal responsibilities of the 501(c)3 corporation); a Board of Delegates (which affords representation to member professional societies); and the Engineering Accreditation Commission (a large body which is responsible for administration of accreditation for engineering programs, with representation from each professional society with responsibility for accreditation for their particular disciplinary program, and with representation assigned proportionally based on size of professional society).

While this appears to be attentive to issues of representation, as subgroups are formed within the Engineering Accreditation Commission (EAC) to work on specific tasks, it is not guaranteed that the interests of all organizations represented on the EAC will necessarily find their voice among
the committee or task force assigned to give articulation to new policy positions. While there are internally defined procedures that mandate discussion and debate of new policy positions within the wider EAC body, the power of this larger body to shape the final product is limited; given the time constraints of an all-volunteer organization, there are real limits to the amount of amending that is tolerated by a governing body at this level within the organization.

It is also important to note that not all voices are represented on the EAC. The composition of the EAC presently only includes those societies with direct authority in the accreditation of engineering programs. Other professional societies, particularly those representing diverse engineering constituents such as the National Action Council for Minorities in Engineering (NACME), National Society for Black Engineers (NSBE), Women in Engineering ProActive Network (WEPAN), Society of Hispanic Professional Engineers (SHPE), Society of Women Engineers (SWE), American Indian Science and Engineering Society (AISES), do not have a direct voice or representation in the EAC. Only three of these organizations have representation on the Board of Delegates (NACME, SWE, and WEPAN) and no organization has representation on the Board of Directors.\(^\text{18}\)

Membership on the EAC is determined by the individual professional societies, and most typically involves individuals who have been deeply involved in the ABET organization over many years, having served as a program evaluator or in other roles. Respect within ABET’s volunteer organization is earned through long and difficult hours of service. From the standpoint of organizational theory, this suggests that EAC members may become as aligned to ABET and its operational concerns (e.g. the challenges of program evaluation) as they are to the desires of the constitutive member organizations that they represent. A review of EAC membership also reveals that a vast majority of members are white males who are either retired or late in their careers; again the risk that this skews the priorities within EAC are real.

Each layer within ABET’s hierarchal organization has different roles, experiences and perspectives. Recently the reorganization of ABET’s Board of Directors, from a single large board to a smaller, limited-membership Board with a clear emphasis on fiduciary responsibility over ABET, and three separate boards of delegates through which representation from member organizations (including ASEE) occurs, has become an important factor in ABET’s decision making process. While there may have been issues such as those of fiscal responsibility and oversight that prompted ABET to make these changes-- and other non-profit organizations have enacted similar changes-- the change enables ABET to act more autonomously, both through the governing board’s isolation, as well as the shielding that it provides for decisions up and down the organizational hierarchy.

ABET’s own interests as an organization include its own fiscal health and survival. As a non-profit organization, it experiences perpetual pressure to maintain fiscal balance, and this has translated into efforts to secure new revenue streams. One manifestation of ABET’s expanding market has been its inauguration of global accreditation activities, which offered opportunities quite different from the highly saturated market for engineering accreditation within the U.S. In 2008, ABET realized its vision of “going global” by accrediting its first program abroad. Then-President L.S. “Skip” Fletcher declared “ABET launched one of the most significant changes in its recent history” and compared the move to the advent of jet propulsion in the 1950s, which, he
said, “enabled many to go farther than they would have otherwise imagined,” and,

made our planet a smaller and more closely knit world. Like jet propulsion, international accreditation will provide global mobility for many technical graduates from all over the world. ABET accreditation will increase the professional opportunities of graduates from ABET-accredited programs as they pursue employment, education, licensure and certification, and other opportunities at home and abroad (2).\footnote{19}

We might note that this rhetoric, found in ABET’s 2008 annual report, has the tenor of a colonialist project, in promoting U.S. educational standards within a global arena. Indeed, from the standpoint of governance, ABET’s international expansion raises questions about representation and fairness. While foreign universities have begun to adopt ABET’s EC 2000, ABET’s volunteer workforce has not yet internationalized, so that most foreign visits are conducted by U.S.-based evaluators. Examining the implication of ABET’s Language Requirements for international accreditation provides a concrete example of concerns for international programs being accredited. According to ABET all international programs are required to provide transcripts in English or official translated copies, self-study reports and supporting documents in English, and the programs must be prepared to host program evaluators in an all English review, with all program evaluation activities conducted in English only. Variations in languages and comfort in explaining technical nuances can be lost in translation, placing international programs at a disadvantage during the review process. Additionally, international universities may incur added financial burdens to support the English only demands of program evaluation. Similarly, the EAC and other governing entities do not have proportional representation in terms of foreign degree programs. What is being exported is also an outcomes-based approach to accreditation that is the product of the neoliberal turn in U.S. higher education. ABET’s global extension contributes to the spread of U.S. neoliberal policies in higher education that may still be alien to the political culture of certain countries.\footnote{20-22} At the same time, it is possible that the proposed changes in accreditation standards, the review of which was initiated the year after ABET “went global,”\footnote{19} are related to ABET’s global operations, and the flexibility necessary to expand their operations in this direction.

As ABET rolled out its proposed changes to EC 2000, the response within ABET has itself varied, including varied responses to the feedback submitted by the member organizations. Understandably, those responsible for ABET’s external image has been different from those sitting on the EAC, which has again been different from the response of the Executive Director. Those within ABET with significant commitments to educational research have also responded differently. Paid staff also have a different relationship to accreditation standards when compared to the volunteer leadership on ABET’s primary accreditation commissions. Delegates ideally maintain the interests of the professional society they represent foremost in their minds. The information different entities within this organization have access to, and the pressures they feel, inevitably influences their actions and reactions in a time of reevaluation such as the one before us now.

At the same time, ABET operates within a broader ecosystem of engineering education
organizations in Washington, including the professional societies, the National Academies, government agencies like the National Science Foundation (NSF), and other coalition-based engineering organizations such as the National Society of Professional Engineers (NSPE), the National Council of Examiners for Engineering and Surveying (NCEES), and the American Association of Engineering Societies (AAES). The departure from the shared vision set forth by EC2000 was met with a significant response from these organizations.

Part of this interdependence that extends beyond ABET’s formal organizational boundaries stems from the fact that ABET’s authority is derived in large measure through its connection to licensure. When a Professional Engineer’s license requires a degree from an ABET-accredited program, as it does in most states, ABET is solidly embedded in the professional landscape as an important gatekeeper. As the sole body for engineering accreditation, ABET is able to wield its influence in particular ways, and command other parties to play according to certain rules. Departments and programs at public institutions who seek to dispense with ABET accreditation often meet with obstacles from their trustees or regents, or their state’s public officials, who insist upon accreditation. Both public and private institutions may run into opposition from students or concerned parents for whom licensure is a critical opportunity. And in the wider landscape of rankings, ABET accreditation matters especially for new programs seeking initial acceptance. While this is a consensual process that universities enter into, it is not one of equal power relations. Given the existing mechanism of representation within ABET, there is reason why discontent—and expectations in general—become voiced through other organizational actors.

The constituent organizations of ABET should also present their views, and under a rational organization model of ABET, the organization would be able to accept this input responsively. However, the reality is that open dialogue has its limits given the kind of decision making process that unfolds within an organization with a natural or open system design. In such a situation, how and whether concerns are aired depends on perceptions about the willingness of ABET to respond to suggestions, and the perceived costs of speaking up. Some feel that the size of ABET’s governing bodies, including the EAC, are too large to allow an effective voice. There are also those who have spoken up who have felt the fear (real in its consequences) of reprisal, and this surely is not conducive to a broad discussion of the issues. As an indication of the message that ABET may be unintentionally sending regarding its responsiveness, ASEE had to request that the official comment period be extended from June 15 to June 30 in recognition of the fact that the ASEE annual conference occurred during this interval. The deadline for the latest round of proposed changes was set once again to June 15, 2017, two weeks before this year’s annual meeting. Such actions send mixed messages about ABET’s desire to incorporate the voice of its principal stakeholders.

Accreditation and the Evolving Pattern of Governance in US Engineering Education

That the formation of accreditation standards for the engineering profession could occur in other ways can be ascertained through a historical survey of the evolving pattern of governance over U.S. engineering education. In the early years, engineering curricular standards were established through a voluntary process spearheaded by our own society, originally the Society for the Promotion of Engineering Education (SPEE). While early articulations of a shared vision for
engineering education occurred through academic forums, the early decades of the 20th century brought with it a Progressive Era tradition of educational reform that developed into a grand investigative tradition that shaped our field from the 1910s through the 1960s.24,25

Beginning with the 1918 Mann Report,26 our Society produced a series of studies that included the Wickenden Investigations of 1923-1929;27 the two Hammond Reports during the 1940s;28,29 the Grinter Report in 1955,30 and the Goals Report in 1968.31 Each of these reports emphasized the need for strong, professional education based on the inclusion of a general education program that ran concurrently with the technical subjects that students encountered as part of their engineering degree program. While science and math was clearly featured in these reports, the humanities and social sciences, which were originally labeled “purely cultural subjects,” were considered essential for all engineering graduates, and were given separate treatment from instrumental subjects such as writing, communication, engineering economics, and labor relations.24,27

This investigative tradition relied on voluntary compliance. Progressive Era reform traditions drew their efficacy from assessing best practices and presenting them back to the membership as a means of establishing a voluntary accountability regime. However, William E. Wickenden, who directed the Wickenden Investigations, came to realize the limits of voluntary compliance in achieving the changes he called for in his reports. In considering the emergence of programmatic accreditation for other professions, Wickenden took steps to develop a system for engineering accreditation.24

While Wickenden made an attempt to redefine institutional membership within SPEE as a vehicle for accreditation, this was considered potentially divisive, and as such Wickenden took up the task of creating the Engineers’ Council for Professional Development (ECPD), ABET’s precursor. In considering, nevertheless, the complex institutional ecology of the engineering profession, ECPD was set up from the outset at a “conference style” organization, with assigned delegates from each of the six major engineering professional societies, along with SPEE and the National Council of State Boards of Engineering Examiners (now NCEES). Given the different standards for professional recognition and licensure among the engineering professional societies, a formal decision was also made to embrace programmatic accreditation at the level of individual degree programs, rather than the institutional accreditation of an entire engineering school.24,32

For decades ECPD looked to SPEE, and later ASEE, as the authority over matters of engineering curricula and content. Thus, despite being nominally a semi-autonomous entity capable of acting on the recommendation of its delegates, ECPD continued to rely on the major studies of SPEE, and later ASEE to set the educational standards that its voluntary evaluators were expected to enforce. However, even by the 1950s, unofficial and opportunistic changes in the governance structure brought about a subtle shift in ECPD’s authority. The educational standards—and in particular, the first set of quantitative standards for accreditation—put in place following the Grinter Report resulted in no small part from the efforts of Cornell University Dean of Engineering, Solomon Cady Hollister, who orchestrated the outcome as the Chair of ECPD’s Education Committee (ECPD’s accreditation arm) and the President of ASEE. The controversy surrounding ASEE’s 1968 Goals Report, which had recommended that the Master’s degree (and
an undesignated one at that) be the first professional engineering degree, wound up further weakening ASEE’s capacity to serve as the “voice” of engineering education.24, 25, 33, 34

While we might presume that ECPD became the de facto site for engineering deans and others with influence to define new educational standards for the profession, this may not have exactly been the case. ECPD became the Accreditation Board for Engineering and Technology (ABET) in 1980. But rather than emerging as a strong voice for engineering education, the delegate structure of ABET kept the organization vulnerable to external influence. In the absence of an external body capable of defining the educational standards that ABET was to enforce, curricular standards were allowed to drift, helped in no part by the shift to quantitative standards. Quantitative standards facilitated a “bean counting” appropriate to accreditation reviews that was based on documenting a certain number of hours spent on particular topical areas, regardless of educational outcomes.25

By the 1990s, representatives from some of the more elite engineering institutions were expressing strong concerns about the audit culture at ABET, which they felt were instrumental only in maintaining minimum standards. Other advocates for change in engineering education came to see ABET as an obstacle to innovation, and as a waste of time for faculty, particularly at elite institutions where meeting those minimum standards was unlikely to be an issue.35-37 All this occurred among rising concerns about national competitiveness, and later, economic globalization. This translated into a neoliberal and unabashedly nationalistic project to transform U.S. engineering professional identities. The hope, at least as far as the public face of this initiative went, was to place them above the engineers trained, in ever greater number numbers, from other, primarily ascendant Asian economies.

Change in this instance began at the top, but also as distributed across multiple organizations. Joseph Bordogna, the Assistant Director for Engineering at the National Science Foundation, was among those concerned about the ways in which ABET accreditation limited the quality of engineering education. He championed a vision of “innovation through integration” across engineering and at NSF. He and other senior colleagues within the profession decried the silo-ing that was occurring in engineering curricula, in which faculty simply taught in their subject area without regard to how that knowledge connected to other subjects, or how a student would ultimately be able to make the connections necessary to put their knowledge into practice. Resisting the over-packed nature of the curriculum, they sought a systemic overhaul of the curriculum focused on integrated knowledge that would better serve the nation’s economic interests.37, 38

NSF provided the institutional mechanism for open dialogue within the profession, specifically by supporting a series of stakeholder workshops that drew together university presidents, engineering deans, engineering faculty, industry leaders, professional society representatives, and ABET itself to air their concerns and chart the path forward. This ultimately resulted in the EC 2000 criteria.39 At that time, broader societal trends were already extending neoliberal modes of governance into the accreditation landscape of both K-12 and higher education, both of which had begun to shift towards student outcomes and accountability metrics.40 Those who designed EC2000 readily adopted this learning outcomes regime as a replacement for the quantitative, “bean counting” approach practiced by ABET.37,41
It should be noted once again that general education, specifically in the form of the humanities and social sciences, was long a focal point of engineering education reforms. Indeed, the first quantitative standard for engineering curricula occurred because of an effort to ensure that engineering programs would not raid the time spent on the humanities and social sciences in order to make space for the increased specialization that was always occurring within engineering—the second Hammond Report issued in 1944 recommended that 20% of time be devoted to what was then called the “humanistic-social stem.”29 and a half-a-year to a full year of coursework in the humanities and social sciences was specified in the ECPD standard that was established following the 1955 Grinter Report.34 However, EC 2000 took the emphasis on professionalism one step further, based on its desire to give U.S. engineering graduates a distinct place within the global workforce. Both in publicly issued statements, as well as anecdotally, it was said that professional skill sets—skills such as teamwork, communication, professional and ethical responsibility, and an awareness of social context—addressed industry concerns about the deficiencies they saw in U.S. engineering graduates,35,42 even as it answered the concerns about national competitiveness and the desired differentiating characteristics for U.S.-trained engineers.43, 44

There is room for discussion about whether the professional standards, and the implied work in liberal education set forth in EC 2000 was achievable in the short term. ASEE’s Liberal Education Division (LED, now the Liberal Education/Engineering and Society Division (LEES)) worried that engineering educators were unprepared to deliver effective education in many of the specific professional skill areas,45 and that engineering programs would not dedicate the necessary time and attention to significantly alter student outcomes in these areas.46, 47 The actual curricular changes produced by EC 2000 have indeed been limited from the perspective of professional education. Latucca’s ABET-commissioned study of changes reported advances in learner-centered pedagogy, open-ended problems, design, and teamwork, but not in other key areas such as diversity or an understanding social context. Moreover, the gains, in some instances, were relatively small.37,44 There are, naturally, exceptions to this overall trend, where some individuals or programs have been able to take the EC2000 vision further, but these exemplars have struggled to scale up their efforts at the national level, due to a variety of factors such as extant curricular commitments and the organizational structure of academic departments, as found in Seron and Silbey’s study of the limits of innovation at Olin, Smith, and ABET itself.48

Still, from the standpoint of educational governance, the important point about EC 2000 is that it was the product of a broad conversation among various segments of the engineering education community. While the limitations encountered in the implementation of the professional vision for EC 2000 suggests that there may have been parties—including the students themselves—that ought to have been consulted more in developing a set of uniform standards that ABET could have been reasonably expected to enforce, the decision about the right direction in engineering professional education occurred through a deliberative process that included a wide variety of actors. Significantly, this was a conversation that occurred in a forum that went beyond the defined procedures encoded within the formal, bureaucratic structure of ABET, and which enabled the articulation of a unified position that went a long way towards recognizing the
diverse and open structure of the engineering profession.

**Comparing the Development of EC 2000 with the Recent Revisions Process**

Given the difficulties many institutions experienced coming up to speed in supporting EC 2000 and especially its mandate to expand professional skill development among engineering students, it is perhaps not surprising that by 2009, there was already pressure to scale back these requirements. Despite the fact that most schools had gone through only one accreditation cycle, there were those in organizations such as IEEE and AIChE who were calling for change.\(^{49}\)

We leave the realm where historical records are generally available, so the following assessment is based more heavily on published accounts, including public statements issued by ABET. ABET’s internal review began in 2009 with a review of the Criterion 3 student outcomes. Whatever the cause, critical attention was directed at the outcomes themselves rather than any possible underlying factors, such as program evaluator training or institutional support for faculty and curriculum development at institutions undergoing accreditation. The Criterion 3 Task Force of the EAC, which was established to carry out this evaluation, was charged to involve stakeholders in its review, consider how metrics would be used to evaluate the revised outcomes, and address continuing concerns about the lack of educational innovation and differentiation even under EC 2000.\(^{50}\)

While this task force consulted with various constituencies, as affirmed by ABET staff, the scope of this consultation should be compared to the dialogue that produced EC 2000. For example, with regards to industry input, the task force worked with its own Industry Advisory Council, as opposed to carrying out either a broader survey of industry leadership, or directly engaging with other industrial associations. While the task force wound up attributing the lack of educational innovation to the length of the a-k list, there was little if any consultation with those in the engineering education research community who offered broader perspectives on the factors that stifle innovation in engineering education.\(^{51-53}\)

In response to the suggestion that the “bean counting” approach persisted despite the move to EC 2000, the task force focused on the outcomes as opposed to other factors, including how its own organizational culture and that of the academic institutions might be contributing to the phenomenon.\(^{50,54}\) All this suggests that the consultative process of the task force, during the formative stages of its recommendations, was substantially insular when compared to the broad dialogue that occurred during the original formulation of EC 2000. ABET has itself cast the process as a matter of internal review.

The Criterion 3 Task Force put forward the recommendation that the EAC ought to eliminate those outcomes that programs had the most trouble meeting, and to also reduce the total number of outcomes from 11 to 6 to make room for innovation.\(^{50,54}\) These cuts also focused almost exclusively on the professional skills that had been introduced with EC 2000. Philip Borrowman, former ABET president, noted that this result stands in stark contrast to the ideals presented at the rollout of EC 2000, when the plan was to work toward the goals of the *Engineer of 2020*. The plan had been to proceed through 3 or 4 accreditation cycles to allow institutions to adjust to changes and improve their processes for meeting the student outcomes before seeking revision.\(^{49}\)
From a governance and organizational theory perspective, the conclusions of the task force and the process by which it reached them reveals a great deal. EC 2000 was developed by a broad coalition that included the NSF and NAE, a broad group of industry employers, professional societies, and leaders from educational institutions. It resulted in a document that served as an aspirational statement for the direction of the profession at the turn of the century. However, a dozen years later, the EAC directed a task force two levels down in the organization to review the learning outcomes, the focus shifted from the needs of the profession to the operational demands of ABET and the preferences of institutions undergoing review.

New accreditation criteria do represent a significant stake for all engineering education organizations, given the adjustments that occur following the development of a new standard. In the wake of EC 2000, many universities made significant changes to their programs. ASEE itself made a number of adjustments in response to the call for expanded professional skill sets. LED (now LEES) produced, for instance, a number of “spin-off” constituent committees and divisions, most notably the Ethics Division. Not limited to those in the humanities and social sciences, and indicative of the import that ASEE members now place on the associated learning outcome, the Ethics Division is now one of the largest divisions in our society. The traditional disciplinary divisions have also responded to this shift. The call to integrate professional skills into the core technical courses within engineering has brought innumerable changes in curricula as well as associated educational research, which are reflected in the papers presented at our annual conference.

Once the EAC Criterion 3 Task Force’s recommendations came back to a national level for public comment, the push for a return to a greater focus on professional skill sets ensued. Perhaps not surprisingly, one of the first groups outside of ABET’s established channels for eliciting feedback was the ASEE Ethics Division. In 2015, at a meeting sponsored by the division at the ASEE Annual Conference, a National Academy of Engineering (NAE) staff member and a Mechanical Engineering Department Head who was an officer in the Ethics Division, raised the alarm about ABET’s proposed revisions to EC 2000 that, as first expressed, would gut broad learning objectives from EC2000 and remove the phrase “professional responsibility” from the ethics outcome, which stunned the audience. The process was opaque as many key stakeholders reported a lack of communication from ABET, including senior management in engineering at NSF, much of the leadership of ASEE, and engineering deans and department heads, including those very active in their respective professional societies. The scope of the proposed changes represented more than an internal review focusing on the operational aspects of accreditation; given the scope of the proposed changes, more direct consultation and communication was expected.

Responsibility for the recommendations had been transferred from the Task Force to the EAC Criteria Committee, and some of the student outcomes slated for removal were reintroduced into a revised version of the criteria advanced by the committee following a preliminary round of input. However, many of the outcomes were reintroduced as combined outcomes in an attempt to still limit the total number of specified student outcomes, this as a means of continuing to support the goal of creating space for educational innovation. Formally, these combined outcomes limit the scope of each outcome due to the “and” construct, which defines how specific
skills are used; while some regard this to be appropriate, it represents a distinctly instrumental shift in the specified skills. From the point of view of those involved with assessment and assessment research, these combined outcomes also present distinct challenges, and they may, in practice, also alter the resources that are devoted to assessing what were formerly independent outcomes.

ABET’s procedure for eliciting feedback has also been based on seeking individual input, collected via a public website. This method makes not formal distinction between whether input is submitted by an individual educator, or a representative organization and lacks transparency as to how the feedback is being processed. (ABET staff have supplied this detail at conferences, but it is not visible to all those submitting feedback.)

Multiple divisions within ASEE developed responses to the proposed changes and submitted them through this mechanism. However, as an indication of changes in organization structure that can facilitate broader dialogue, our society also undertook to formulate a broader articulation of member views. This initiative was undertaken by a body, the Ad Hoc Committee on Interdivisional Cooperation, which emerged as a ground up initiative to combat the virtual silos into which many (including the Board) have felt that ASEE divisions have found themselves. This group had previously created an annual forum known as the interdivisional town hall meeting, and used this venue this past year to serve as a society-wide forum for assembling ASEE member views regarding the proposed changes. A virtual conference organized several months prior to the annual conference provided a means for all ASEE member to express their views, with a summary being compiled by an officially sanctioned Feedback Committee with broad representation. The annual meeting was also used to review and revise this summary, which as then officially transmitted to ABET. The current set of proposed changes incorporate some of the suggestions generated through this forum.

Still, is this an optimal process for a major change in accreditation criteria? Some have maintained that ABET is entirely right to conduct an internal evaluation focusing on the operational aspects of accreditation. Accreditation standards are a living document, and the EAC accreditation criteria have undergone multiple changes since the original articulation of EC 2000. However, if the scope of the proposed changes, even in their current form, represent a significant change in the underlying intent of EC 2000, this raises questions about whether the decision making process falls short of the broad conversations that ought to accompany any significant change in engineering accreditation standards.

**A Review of Professional Standards Going Forward**

Questions remain about the impact that the proposed revisions will have on the professional training of engineers. The omission of the phrase “Humanities and Social Sciences” may represent a desire to be inclusive, in recognizing that other subjects, such as the Arts, may be instrumental to the broad education of engineers. However, given the longstanding tension between liberal education and subjects with more direct instrumental value to engineering practice (such as public speaking, management, engineering economics, and finance) this can also produce a significant shift in educational content. If the intent were simply to recognize the Arts as a valid means of cultivating a broad, professional outlook, the phrase, “Humanities, Arts,
and Social Sciences” might have been a better choice. If, on the other hand, there is a desire to rebalance student outcomes with an increased focus on instrumental knowledge without the emphasis on a broad, liberal education, then this amounts to a significant shift away from the professional vision laid out by EC 2000. While the removal of the phrase “broad education” from Criterion 3, and the reference only to a “broad education component” in the revised Criterion 5 follows a certain logic, it nevertheless fuels the concerns on the part of those who see a shift in emphasis. A test of ABET’s intent may be their willingness to include liberal education as a necessary perspective for the proper formulation of the projects that engineers undertake. They might, for instance, revise their first student outcome to read, “an ability to formulate and solve problems by drawing on fundamental knowledge in science and mathematics, as well as their broader education within the liberal disciplines.”

Another significant blow to those favoring a liberal vision of the engineering profession lay in the omission of any reference to credit hour requirements in general education. In its current version, Criterion 5 still at least specifies that “faculty must ensure that the program curriculum devotes adequate attention and time to each component,” which includes the time devoted to the general education. Prior to EC 2000, the requirement had been that programs spend at least six months in this subject area. While EC 2000 had already removed this quantitative standard (while retaining one for the basic science and engineering components), there nevertheless remained strong safeguards for liberal content because of their strong emphasis within the a-k student outcomes criteria. However, operating together, the shift to combined outcomes, the reduced emphasis on this content, and the actual removal of the phrase “adequate attention and time” in the current proposal present a real risk to the further erosion of liberal content within engineering education. Given the broader conservative context in which our nation finds itself, and the predominantly neoliberal framing of all recent educational reforms, this again represents a serious change in direction to which we must remain cognizant.

In returning to matters of governance, the vulnerability of those with a commitment to liberal professional education may be a product of the disenfranchisement of non-engineers from ABET’s formal organizational structure. While the Liberal Education Division has previously made a formal overture to ABET to have non-engineers join the ranks of program evaluators, they have been rebuffed in their effort, this despite the very significant presence of learning outcomes in ABET’s accreditation standard that draw on specific expertise within the division, such as communication, ethics, and analysis of the social context of engineering. Given that those occupying senior volunteer positions within ABET, including the Board of Delegates, Commissions, and Criteria Committees begin their involvement as program evaluators, it is clear that the organization has cut itself off from those with relevant expertise to carry out the goals of EC 2000. Having those who understand the broader social context in which engineering education operates would seem invaluable to the organization. What would it take to change this aspect of governance in engineering education?

It also bears mentioning that the American Society of Civil Engineers has taken a stronger and more unified stand in opposition to ABET’s proposed changes than ASEE. We in ASEE would be wise to study that organization’s governance structure for clues to how it was able to respond clearly and with one voice on this matter. With its strong connection to licensure, ASCE has the option to undertake their own accreditation effort as tied to the system of licensure if ABET
criteria do not meet the needs for civil engineering education. (Lest this be regarded as unrealistic, the separation of professional accreditation from institutional accreditation occurred through just such a move—although the added costs of accreditation visits will surely be opposed by university administrators.)

What potential is there in enhancing the influence that outside actors have on ABET? Given the broader erosion of liberal education in US higher education, those in the humanities and social sciences do feel a general sense of precarity. What would happen if the IEEE Professional Communications Society, or LEES and the Ethics Division of ASEE, found reinforcement from the Society for Social Studies of Science, the International Network for Engineering Studies, the Society for the History of Technology, the National Communication Association, and other organizations with a stake in this process? So far these organizations have not taken an interventionist stand in ABET’s deliberations. How can we empower members in these societies to raise a collective voice on this important issue?

In comparing the process for EC 2000 and the recent revisions, it is clear that without the involvement of NSF and NAE, ABET either lost sight of, or chose to diverge from the national priorities for the profession that had been orchestrated through consensus. A much more concerted, long haul effort is needed to understand the landscape of individuals, organizations, and ideologies at play in the periodic redefinitions of our educational standards. But if a national vision for the profession is to remain in the foreground, the leadership of NSF and NAE must not only be committed to these principles, but must also have the courage to take action to defend them. The engineering education community, in turn, needs to make our concerns known to them and advocate for their strong action. How do we engage senior management in engineering at NSF and the leadership at NAE to take an active role once again in maintaining a strong vision for the engineering processes? How would we normalize this relationship so that they have appropriate involvement in future rounds of revision that will surely occur?

Conclusions and Recommendations

Engineering Education’s systems of governance have changed over time, but the distributed nature of authority over the profession, with its distinct disciplinary flavors and professional silos, ensures that conversations about change in engineering education will always be difficult. Greater attention needs to be paid to matters of process, and how the governance structures and the routinized procedures that are embedded into the bureaucratic apparatus of organizations such as ABET channel conversations in ways that both serve and hinder progress within our profession. Nor can the changes be limited to ABET alone. We need to become active agents in transforming the existing governance structures within the engineering profession at large to facilitate more inclusive participation in setting the future directions for the engineering profession. We must insist and persist in this endeavor.

With regard to what we can do within our own society, ASEE, as a first step, should improve its own distributed structure to allow for better deliberative processes and improved avenues for communication that would ultimately allow the membership to speak with one clear voice on issues of importance to engineering education. Initial efforts such as the town hall conversation on ABET changes met with good success, but these efforts need to be strengthened and
regularized, with a formal organizational structures put in place to carry out such activities.

The present, hierarchical and coalition-based organizational structure of ABET will persist only so long as that structure continues to serve the needs of its constituents. As ASCE pushes back on the current changes, ABET’s responsiveness to those concerns may also signal critical avenues for action by those of us passionate about holistic education of engineers.

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