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ABET's Maverick Evaluators and the Limits of Accreditation as a Mode of Governance in Engineering Education

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ABET's Maverick Evaluators and the Limits of Accreditation as a Mode of Governance in Engineering Education

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This paper is about ABET's[1] maverick evaluators and what it says about the limits of accreditation as a mode of governance in, which is to say it's capacity to shape and control U.S. engineering education. The term *maverick* is not meant to be pejorative. As defined in the Merriam Webster dictionary, a maverick is "an independent individual who does not go along with a group or party"[1]. In the context of this study, it refers to an evaluator in ABET's engineering accreditation process whose approach to evaluation is at odds with ABET's published accreditation criteria, or at least how ABET's Engineering Accreditation Commission (EAC) expects their evaluators to interpret the criteria in their evaluation of a program. This label, along with other variants, are often said in the context of the contentious encounters that will often arise in any audit culture. However, in the case of ABET the phenomenon of maverick evaluators also point to competing ideas about educational improvement that are embedded within the ABET criteria themselves. Indeed, in this paper we look at maverick evaluators in order to identify a tension between professional standards, educational quality, and educational innovation that became encoded into ABET's accreditation criteria during the 1996 reform effort known as "Engineering Criterion 2000" (EC 2000). Also, because of EC 2000's architects' decision to embrace outcomes assessment—but to do so only in part—ABET's program evaluators (PEVs) were placed in the difficult position of having to balance the goals of educational standardization, improvement, and innovation across the diverse spectrum of institutions through which we deliver engineering education in the United States.

The case study is also significant because outcomes assessment has been part and parcel to the expansion of neoliberal modes of governance not only in engineering education, but higher education as a whole. Indeed, EC 2000 served as an important stepping stone for the general implementation of outcomes assessment across U.S. higher education via our country's regional accreditation agencies. Because of the challenges involved in revealing the multiple facets of a complex phenomenon, we adopt a story-telling approach, without a specific research question or a narrow finding, in revealing, step by step, the underlying structural causes that shape engineering accreditation and assessment as practiced in the United States today. We ask for some patience as we take this approach to understanding maverick evaluators, and what they reveal about ABET and its accreditation practices. This study should not be construed as a criticism of ABET; a measure of inconsistency is inherent to voluntary accreditation processes of any sort. Instead, we aim to map out ABET's accreditation practices, and their underlying causes, as a way of assisting ABET, their volunteers, and the academic institutions that rely on

[1] Formally incorporated as the Accreditation Board for Engineering and Technology, ABET has presented itself as ABET and ABET Inc. since 1980.

their services to improve upon their practices and outcomes. We close with several, still preliminary recommendations addressed to these three audiences.

Method

The data presented in this study is the product of a broader, exploratory study of change processes and governance in U.S. engineering education. Organized around a basic, multi-sited, multi-scale research design, our research team carried out 277 semi-structured interviews at 43 academic organizations, including 33 different colleges and universities. We also conducted supplementary interviews of over 40 engineering students and their educational experiences. Site selection was based on considering geographic location (4 regions); institutional type (public and private; general universities, engineering colleges, liberal arts colleges, and community colleges; PhD and non-PhD granting institutions); and institutional rank (top 10, 10-30, and 60 and below on U.S. News and World Report undergraduate engineering rankings [2]). For subject selection, we invited each college to nominate those individuals whom they felt were most appropriate for our study according to a specified selection criteria. This criteria included a request to speak with the president, provost, or member of their office; engineering dean; an associate dean; department heads in electrical or biomedical engineering and in civil or mechanical engineering;

Table 1: Distribution of Interview Subjects
From U.S. News and World Report Undergraduate Engineering Program Rankings [2]

Institutional Type	# Institutions	# Institutions w/ 4+ Interviews	Total # Interviews	Total Interv. w/ substantial ABET content
Doctoral granting, Rank 1-10	6	6	53	37
Non-doctoral, 1-10	5	5	51	43
Doctoral, 11-30	4	4	36	29
Non-doctoral, 11-30	4	4	25	21
Doctoral 60+	7	5	41	23
Non-doctoral 40+	2	1	5	5
Community colleges	5	0	5	0
Other academic organizations	9	6	43	34
Individual interviews, excluding students	n.a.	n.a.	18	8
TOTAL	**43**	**31**	**277**	**200**

faculty with tenure, without tenure, and a non-tenure lecturer; an individual with ABET experience; and a faculty or staff member involved with advising. Individual subjects could cover more than one role. Different criteria were supplied to other academic organizations, including ABET and ASEE. Although not every institution scheduled interviews with the full complement of subjects requested, 31 academic organizations, including 25 colleges and universities allowed us to interview between four and 14 individuals, which we regarded as sufficient to gain a general picture of how change processes occurred at those institutions. Within the limits of what we can disclose for reasons of confidentiality, the general distribution of our interview subjects is provided in Table 1, above.

Our semi-structured interview protocol (fixed questions with an opportunity to ask follow-on questions), in its different versions, consisted of between 13-17 open ended questions with pre-scripted follow-on questions for several of the basic questions where the underlying issues were already known. (The number of basic questions varied because our protocol called for periodically adapting our questions based on interim data analysis.) The data from this article is based on one such bank of questions pertaining to ABET, including an effort to capture the subject's attitude towards accreditation, general accreditation practices at their institution, and their opinion on known issues such as PEV training and consistency. We are preparing a separate article, slated for a peer-reviewed journal, which reports more directly on the issue of how academic institutions and their programs responded to EC 2000, and a more robust account of how assessment and accreditation are practiced at engineering schools today. We note that each interviewer was given full discretion regarding how to direct their questions and where to focus their interviews. We deemed 200 of our 277 interviews to have substantial content related to ABET accreditation.

The phenomenon of the maverick evaluator emerged into focus during our dynamic coding efffort, wherein we noticed, then took note of all instances where our interviewees spoke about consistency, PEV training and variation, and their frustrations with the review process. While coded as "inconsistency," "PEV variation," and "PEV training," and a number of other ancillary terms such as "due process review," the specific terms employed during each interview varied. Concerns about inconsistency occurred with some regularity, but our claim here is not that this is a pervasive problem. Our broader paper on institutional responses to ABET will present numerical findings regarding the distribution of attitudes towards ABET found among our interviewees. That said, because of our purposeful approach to subject selection, the exact extent to which inconsistency is a challenge for ABET remains unknown, and would require a statistical survey with a controlled sample that accurately represents the different rank and type of engineering schools that exists across the U.S (and the world). The focus of this paper is instead on what maverick evaluators and the general phenomenon of inconsistent evaluations reveals about the limits of engineering accreditation as currently practiced, including ABET's present approach towards outcomes assessment and its deployment in efforts to ensure both quality assurance and continuous improvement.

Background

First, some background. In order to understand the tension that exists between standardization and innovation in U.S. engineering education, it's helpful to know that engineering education in

the United States is delivered through a diverse institutional ecology composed of public and private institutions; general universities, dedicated engineering schools, some liberal arts colleges; and well over 50 different state systems of higher education. While this diversity is an asset in terms of our national capacity to generate new knowledge and to train a diverse STEM (Science, Technology, Engineering and Mathematics) workforce, it also propels engineering schools to differentiate themselves through differences in programs and curricula. Since 1936, the Engineers' Council for Professional Development (ECPD), and its successor, ABET Inc., has worked to bring a measure of uniformity to engineering education through accreditation. A familiar mechanism of governance found across higher education, including its professional segment, accreditation operates through a voluntary system of audit in which evaluators review institutional self-studies and visit institutions in order to certify that academic institutions and their degree programs conform to standards set by the accrediting organization.

ECPD was established in 1932 in the wake of the ASEE 1929 Wickenden Investigations, and began accrediting engineering programs in 1936. As described by Reynold and Seely in their centennial history of our organization, ASEE was hesitant to take on a function that might introduce tensions within their imagined community of disinterested scholars [3]. This prompted Wickenden to work independently to create ECPD, based on one of the recommendations of his study. However, in echoing broader divisions within the profession, ECPD organized its accreditation process around individual degree programs, not engineering schools, resulting in the need to maintain a large, voluntary workforce of program evaluators to carry out accreditation.

Because of the instrumental conception of engineering knowledge—the idea that engineering should always change to meet "changing times and needs" [4]—standards for engineering accreditation has shifted regularly over the decades. The Cold War consensus around the engineering sciences led to a more quantitative system of accreditation that emphasized basic math, science, and fundamentals. Concerns with manufacturing productivity during the 1970s and 80s led to an increased emphasis on engineering design. Then during the 1990s, in the wake of widespread conversations about "national competitiveness" and growing concerns about economic globalization, ABET shifted its focus to curricular flexibility and a greater emphasis on professional skill sets—writing, oral communication, the ability to formulate problems and apply knowledge, working in multidisciplinary teams, and the like. These were the skills that ABET's stakeholders agreed were most important for U.S. engineering graduates to contribute to the national economy. In 1996, they were made the cornerstone of ABET accreditation through Engineering Criterion 2000 (EC 2000) [5].

The call for greater flexibility was the result of widespread efforts, during the 1980s, to make academic institutions more responsive to market forces. However, ABET's detailed curricular standards, which had grown more detailed over the decades, emerged as a constraint that ran in the opposite direction. As accreditation visits grew increasingly contentious, there were growing accusations that ABET PEVs were bean counters who didn't understand where engineering curricula needed to go, especially in regions and at top-tier institutions who were being asked to meet new high-tech workforce requirements. As a consequence, one of the main changes that EC 2000 embraced was a radical reduction in curricular specifications. Whereas the extant standard for curricula was over five pages long, the following articulation of Criterion 4 (now Criterion 5)

became the sum total of curricular requirements under the general criteria for engineering accreditation. ABET's member societies could introduce greater specificity under supplemental degree program criteria, but EC 2000 also stipulated that program criteria were limited to providing "specificity needed for interpretation of the basic level criteria as applicable to a given discipline," and only in the areas of "curricular topics and faculty qualifications" [6]. Proposed program criteria were also subject to review by the Engineering Accreditation Commission (EAC) and approval by ABET's Board of Directors. Given the representative structure of the commission and the ABET Board, this ensured that there would continue to be an emphasis on fundamentals versus specialization in all accredited engineering curricula.

Figure 1. Engineering Criteria 2000, Criterion 4
(Effective for 1999-2000 Cycle) [7]

Criterion 4. Professional Component

The professional component requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The engineering faculty must assure that the program curriculum devotes adequate attention and time to each component, consistent with the objectives of the program and institution. Students must be prepared for engineering practice through the curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating engineering standards and realistic constraints that include most of the following considerations: economic; environmental; sustainability; manufacturability; ethical; health and safety; social; and political. The professional component must include

(a) one year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline

(b) one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study

(c) a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.

At the same time EC 2000 represented a basic shift in ABET's approach to accreditation. Partly in compensation for the flexibility granted, EC 2000's architects adopted outcomes assessment as their chosen strategy for pushing engineering programs in a new direction, specifically by expanding their emphasis on the professional skill sets deemed evermore important by employers and the profession. These were the eleven "a-k" outcomes that were originally mandated under Criterion 3 (Program Outcomes and Assessment, originally) [5]. This turn from "inputs," or a focus on curricula, faculty, facilities and the like, towards "outputs," or student learning outcomes, was part of a broader trend in U.S. education, first within primary and secondary schools, but then also with several other professional accreditation organizations. While No Child Left Behind (NCLB) wasn't enacted as a federal standard until 2001, and hence only after EC 2000, the Texas Assessment of Academic Skills, under then Governor George W. Bush, was already being implemented in the early 1990s and was being widely hailed (if also challenged) as a miracle [8].

Not coincidentally, this also represented a distinctly neoliberal turn in U.S. educational governance. Neoliberalism may be a term that engineering educators and social scientists alike today may be inclined to tune out. To some educators, it may sound like political jargon from which they keep their distance; for those in the humanities and social sciences, neoliberalism may seem dated, having supposedly lost its relevance and analytic charge following the 2008 financial crisis [9]. However, scholars such as Harvey [10] and Steadman-Jones [11] have firmly established that neoliberalism has been a widespread political economic movement that had real effects on public and civic institutions, including higher education. Moreover, regardless of its decline as a guiding economic doctrine, neoliberalism survives as a body of practice in the institutional strategies and bureaucratic apparatus that have continued to bring market mechanisms to bear on many non-market institutions. For engineering educators this is something that ought to be entirely familiar. Our broader data set points to many educators' concerns about the U.S. News and World Report ranking system, the accountability metrics employed by state education departments, and the general effort to bring managerialism to engineering education and to higher education at large. It is worth recognizing that these are all part of a general trend that has continued to operate in higher education, regardless of any proclaimed decline of neoliberalism. In fact, we follow Aiwha Ong and Loïc Waquant's lead in regarding neoliberalism to be a "mobile technology" best studied not just as a political economic doctrine, but a mutable set of practices that should be subject to empirical study [12, 13]. This also enables us to consider how an ostensibly neoliberal practice could lose some of its effectiveness when deployed in a specific institutional setting with a variant logic.

Outcomes assessment, especially as practiced in K-12 education in the U.S., was firmly neoliberal in both spirit and practice in that it offered control-at-a-distance. Frequent concerns about how teaching has become about teaching to the test speak to the influence of this reform movement. Nominally, EC 2000 was also designed to allow ABET to operate at a distance by specifying the outcomes it wanted to see in engineering graduates, leaving programs to choose whatever implementation was required to achieve those goals. This was itself another concession to the call for greater flexibility. And while several of EC 2000's architects have claimed that they arrived at this idea on their own, it's clear that outcomes assessment was already a well-known method for evaluating educational programs and holding its teachers accountable. On the other hand, the diffusion of the method into engineering education was also facilitated by a widespread interest in quality control among engineers and engineering educators during an era of broad concern about national competitiveness—this was a time during which there were many excited conversations about Japanese management, "Six Sigma", "Total Quality Management," and the like. Given the epistemic contiguity between educational assessment and their own knowledge of quality control processes, those who were placed in charge of implementing EC 2000 were quick to recognize that a focus on educational assessment was also about a commitment to continuous improvement [14].

Finally, from the standpoint of this paper, it is important that EC 2000 was a compromise. In pointing once more to the importance of paying attention to governance in mapping changes in engineering education, the ABET Board at the time operated through a representative structure composed of delegates from the member engineering professional societies. EC 2000 therefore had to operate within the limits set by the expectations of these organizations. As a result, Criterion 4 upheld the basic curricular structure of the pre-EC 2000 era by continuing to insist

that all accredited programs include a year of basic math and science and a year and a half of engineering topics grounded in engineering science and engineering design [6]. Translated into the specific practice of an accreditation visit, this meant that PEVs had to maintain a dual focus on both inputs and outputs. Moreover, the focus on flexibility, which was manifested in the published criteria, gave academic programs as well as PEVs considerable discretion in how they interpreted ABET requirements, creating challenges for both. This discretion, paired with ABET's heavy reliance on volunteer evaluators, is what generates the phenomenon of maverick evaluators, and inconsistent program evaluation outcomes, more generally. We turn to the data to gain a better understanding of the phenomena, and insights into how ABET resolved the problem in ways that partly limit the efficacy of their new approach to accreditation.

The Maverick Evaluator

For readers unfamiliar with ABET accreditation, it is probably helpful to begin with an overview of the ABET accreditation process. Since its origin, engineering accreditation was placed on a six year cycle so that during any given year, one out of six schools that participate in accreditation undergoes review. Formally the accreditation cycle takes around 18 months, beginning with a request for review submitted by January 31st of the year in which the review occurs The institution must then prepare a self-study by the end of July, composed of separate reviews for each academic program undergoing accreditation—ABET notes that they accredit "programs only," not degrees, departments, colleges, or institutions. For engineering programs,[2] the Engineering Accreditation Commission (EAC) then assembles an evaluation team composed of a program evaluator from one of the engineering professional societies with responsibility for each of the named degree program at the institution, and a team chair, an experienced PEV who is generally also an EAC commissioner. A site visit occurs between September and December, at the end of which each PEV reports on their findings during an "exit meeting" and in the presence of the institution's senior administrators. These findings are then compiled into a "draft statement of preliminary findings and recommendations" during which "shortcomings" of different degrees—a concern, weakness, or deficiency—may be identified for each program. Following this, ABET follows a significant "due process" review of the initial findings by having several members of the EAC edit the draft statement with a focus on consistency across programs and across institutions [15]. Institutions are then given 30 days to respond to any shortcomings identified in the statement before the EAC meets in July to make their accreditation decisions, which might include required actions [16]. Additional details, where relevant, will be discussed in the context of this paper.

Again, we use the phrase *maverick evaluator* to refer to individuals whose views regarding engineering accreditation are at variance with ABET's published accreditation criteria and how they are expected to be enforced. This first quote captures the general sense of the encounter when such an individual appears on an ABET accreditation team. The quote also refers to a less common situation when two evaluators, presumably in some kind of arrangement for extended training, are sent from the same discipline:

[2] ABET also accredits programs in applied and natural science, computing, and engineering technology.

> ...I was more the senior EE visitor and there was a computer engineer from IEEE and they had told me, watch out for this guy. That he was from industry, and he was inventing criteria. And I would challenge him on that.
>
> And finally I said, 'You know you don't get to do that. You don't get to say well I think we should be looking for this and that.' And he finally summed it up to me by saying, 'Oh, we are seeing if the school is adequate, not whether we would send our children to this school.' And I was like, 'Well okay yeah, if that's how you want to word it that's what we're doing, yeah.'[3]
>
> *(ABET PEV; faculty, state university)*

Many experienced associate deans and others who serve as ABET coordinators at school or college level are familiar with the phenomenon, and can recount specific instances where one or more evaluators appeared to be too critical of their program.

> A college of our size—we've got whatever it is, 10 or 11 programs—we're gonna get a so-called rogue evaluator. One of them is gonna be, and we had a guy who was just ... this time our ME guy was just over the top, and he was so off-base that I got them to agree that there were factual errors in his exit statement.
>
> *(Associate dean, engineering, state university)*

This experience is not necessarily typical of all institutions, even large ones; a preliminary review of our other data suggests that problems with accreditation occur more frequently at institutions that take a more compliant attitude towards accreditation. Moreover, pejorative terms, such as "rogue evaluator," arise in the context of disagreements about a shortcoming, and should be understood as such. While it may indicate a problem with an evaluator, it may also be the result of an actual shortcoming that those who are being evaluated do not wish to accept. While concerns point to areas that a program is not required to address immediately, weaknesses point to issues that need to be addressed before the next general review and may require an interim visit. A deficiency points to an issue serious enough that the program will not be accredited. This becomes a burden for any program, but it can be a special burden for new programs that will have to operate as an unaccredited program until the next visit. Both weaknesses and deficiencies also require programs to do additional work, either in responding to or challenging an evaluation, or in the work needed to make modifications to their program or their assessment and continuous improvement processes. Our interviewees make it clear that the stakes of a failed accreditation are considered to be quite high.

ABET also seeks feedback from the institutions following each accreditation visit. They regularly review this data, and work to identify and retrain or release PEVs whose evaluations are out of line with their expectations. They regard this to be essential to ABET's own continuous improvement process, which they consider to be an essential part of their role as a quality assurance organization [17].

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[3] Note on quotations: Quotations in this article have been minimally edited for clarity and flow, with [square brackets] used to indicate word substitutions, and "..." used to indicate omitted words and digressions. Where the interviewee indicated that permission was required before quoting from the transcript, alternate wording has been reviewed and approved by the interviewee.

This said, ABET's reliance on volunteer evaluators necessitates a constant pool of new recruits from whom aberrant evaluations may arise, and our data suggests that this variation occurs for one of three reasons, two of which have already been identified above.[4] First, experienced ABET coordinators are wary of new industry evaluators who may want to see something in a program that the faculty believe is not what an academic program should focus on, or who appear not to understand the resource constraints under which universities operate. This might be about access to state of the art facilities, or safety protocols of a type universities don't often follow. Or it might be an interest in more practical training or greater specialization in ways that are at odds with a focus on fundamentals.

Second, new PEVs with a background in civil and mechanical engineering and other allied disciplines are often singled out as being more likely to be a maverick. This relates in turn to internal divisions within the engineering profession, and the requirements for professional licensure. The American Society of Civil Engineers (ASCE) and the National Society of Professional Engineers' (NSPE) interest in professionalism and professional training has repeatedly surfaced in history as a tension within the engineering profession at large, and in contemporary conversations about ABET's accreditation standards [18, 19]. The difference in how their evaluators might approach accreditation is noted in various ways.

> These are hard stories… Whenever you have people doing the assessment, it depends on the person doing the assessment, and quite honestly, this would be the second time I've said this. It happened to us with civil engineering. Again, there was this time that an incredibly dogmatic evaluator came to us, answered with, "This is – that's not design, that doesn't fit in our definition of design," right?
>
> *(Associate dean, public engineering school)*

While dogmatic evaluators might appear to be the inverse of other maverick evaluators, they are regarded to be part of the same phenomenon because their evaluations, which is more about how a criterion is interpreted versus an expectation not grounded in the published criteria, still lead to shortcomings. A different kind of concern regarding civil engineering can be found in the following quote.

> But civil engineering is a great example, civil engineering will not let anybody be an evaluator unless they are a licensed professional engineer. Therefore, they eliminate off the bat a lot of the high tech related civil people and that just goes back to the culture of civil engineering.
>
> *(Department head, mechanical engineering, public engineering school)*

EC 2000's emphasis on professional skill sets, and the uncertainty associated with how they are assessed, have also added to the possibility of a contested evaluation in civil and environmental engineering and related disciplines.

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[4] While one of our reviewers notes that PEVs might also diverge from ABET's accreditation criteria based on a social justice agenda, this didn't arise in our data. Many of the maverick evaluators would identify as doing advocacy, but as one might expect from the age demographics of PEVs, more for the reasons of corporate, professional, and educational interests described below.

The fact that ABET has to rely so heavily on volunteers also has consequences, which emerges as the third reason for variance. Because of its decision to accredit programs, not colleges, ABET has always had to rely on volunteer evaluators, and they rely on the member societies to recruit, and originally, to also train the PEVs. However, the multiple demands that have been placed on engineering faculty in recent decades have often made it necessary to rely on retirees and those later on in their careers for whom one of the major motivations is giving back to the profession. This has meant, sometimes, that these individuals arrive with different if not necessarily more traditional ideas about engineering education and curricula. In addition, the volunteer ethos translates, for some, into a desire to make a difference. Beyond the benefits of travel, staying connected with a discipline, and the standing gained or retained through continued professional service, the sense of having an impact often emerges as an important reason for serving as a PEV. Indeed, the first quote, read orthogonally, points to a PEV who is enthusiastic about improving U.S. engineering programs through their commitment of time.

ABET's approach to accreditation also casts each PEV as an autonomous agent responsible for the evaluation of a single program. This can be contrasted against the practice of organizations such as the main U.S. regional accreditation agencies, where the visiting team confers with one another to render a common decision about accreditation. To resolve the tension between the responsibility given to evaluators and the need for a common process and criteria that programs undergoing review deem reliable and fair, ABET accreditation teams do meet throughout and at the end of an accreditation visit to discuss their findings. Moreover, one of the team chair's primary roles is to help calibrate their PEV's evaluations in a manner consistent with the published criteria. The Engineering Accreditation Commission's commissioners, who again serve as the team chairs, are therefore expected to help bring aberrant evaluations in line with common expectations about the published criteria. However, this requires a combination of experience and interpersonal skills that not all team chairs possess. Themselves volunteers, there have in fact been known to be maverick team chairs:

> You know, I think unfortunately, your interaction with the PEV depends a lot on their sort of personality and so forth. The time we had trouble, I think we all in retrospect felt like there was nothing we could have done. …
>
> Interviewer: So that was a program evaluator, not the team chair?
>
> Well, I think that year it was both. … I mean, I was told that the team chair instructed every evaluator to find a deficiency. So those things happen.
>
> *(Department head, liberal arts college)*

While what was stated here is hearsay, we have been told that the EAC will remove team chairs who operate outside of accepted parameters. However, the damage done by such individuals, not only to a program but to ABET's reputation, can be significant [20].

Quite a few of our interviewees note that ABET has done "as well as they can" [21] to improve PEV training. Originally, ABET retained its prior practice of having the member societies train their own appointed PEVs; it had no extensive in-house capacity to conduct training. However, it

became clear that some of the societies were using these training sessions to introduce "shadow criteria," in what seemed like a way around the language placing limits on the content of program criteria. ABET's early training program, which relied on several hours of PowerPoint slides, was transformed into a two-day, simulation based exercise developed in conjunction with training specialists. Prior to the pandemic, the training was also conducted in Baltimore to ensure consistency and to get the volunteer PEVs to experience and sign on to the values of the organization. While the professional societies still select PEV candidates, the EAC will only accept and assign candidates who they feel performed well enough during training. ABET also operates refresher courses and team chair training to improve consistency [22].

Nevertheless there are underlying reasons for continued variation in the initial evaluation outcomes. In fairness to ABET and their PEVs, there are still administrators as well as faculty who misunderstand ABET's accreditation requirements. There are also those who remain confused at a more fundamental level by ABET's purpose, although this may result in part from ABET's own push for educational innovation. (While continuous improvement is mandated under Criterion 4, improvements do not necessarily hinge on educational innovation.) For instance, there are programs that have used the ABET process to document their strengths and, in effect, what's unique about their program, without acknowledging that PEVs are trained to look for compliance. The following quote is in response to a question about the interviewee's overall attitude towards ABET:

> It was the most ridiculous warning… basically they had made a change that program educational objectives had to be something graduates achieved at the time they graduated instead of three to five years out, or it was one way or the other. Essentially what it came down to was a tense problem in our program educational objectives. We looked at the evaluators and said, you're seriously going to give us a warning for that?
>
> *(Faculty, private engineering school)*

From the point of view of ABET, this is a program, regardless of its quality, that failed to answer to ABET's accreditation criteria. Under Criterion 2 (Program Education Objectives, or PEOs) as it was defined at the time, tense did matter. In a 2015 revision to the engineering accreditation criteria, ABET changed its definition of PEOs to indicate that programs should specify "what graduates are expected to attain within a few years of graduation" [23], and explained in a separate memo how this was about "measuring attainment after graduation." This meant in turn that programs were supposed to assess their alumni, which was often done via a survey conducted some years after graduation [24]. Such gaps in understanding do occur, and are best understood in terms of the challenges of inter-organizational communication, especially when individuals on both sides of an audit consider their involvement with ABET to be one of their many responsibilities.

That said, we also observed substantive disagreements about whether a particular accreditation criteria or the associated mandate for assessment were reasonable. This particular quote also extends the previous discussion of PEOs.

> I was thankful that in this last round, ABET took out assessing PEOs, program education objectives. You still have to have them, for where the long-term process goes, but you don't have to assess them. You know, again, that's hard, right? That's what our graduates are doing now. I have no control over what they're doing now when I teach them as an undergrad.
>
> ...I think ABET really does want to have us think about how successful our students are afterwards. But as the faculty member that's teaching the students the technical piece, I don't know how I'm supposed to do that very well. And then the amount of time, I mean, I spend then hours you know developing surveys to go to alumni, then trying to analyze the data that we get back. And you know, is that really how I should be dedicating my time?...
>
> It's not helping my students today. Right? It's allowing you to check a box.… I am someone that cares deeply about the success of my department and my students. Our students. Which is why I do this. It's because it's important to them that they have an accredited program to graduate from and move forward from. But I would rather be spending my time working with them, than checking boxes. … Sometimes I think it's a lot of extra work for us.
>
> *(Professor, state university)*

It does in fact take time and effort to contact graduates and collect data of this kind. But the complaint here is also that programs aren't able to control what students do after graduation, introducing uncertainty into the data. While it may have been sufficient to statistically demonstrate that graduates were performing as well as might be expected as a result of the education they received, such an approach to assessment may have grated against an engineer's epistemic sense that causes needed to be isolated rather than simply subjecting the data to correlational analysis.

Prior to the 2018 revisions to ABET's accreditation standard, there were also concerns about several of the Criterion 3 outcomes. A notable example was the requirement, under learning outcome (d), that students be able to "function on multidisciplinary teams" [25]. Insofar as most programs utilized their capstone design experience to bring their students together, most colleges mix, at best, students from different engineering disciplines rather than drawing on students majoring in business, economics, and other relevant fields such as history, psychology, and anthropology. Some programs also simply choose projects that require multiple disciplinary perspectives to be applied without requiring the students themselves to come from different disciplinary backgrounds.

> The current guideline says multidisciplinary capstone design. [In] the new guideline, which will probably go live December 1, "multidisciplinary" has been removed. … Do you want the reason why? So, I'm one that personally likes "multidisciplinary" because all real engineering problems of consequence are multidisciplinary. [However at] most schools, including many programs at [our school], you run into problems immediately with that because civil engineering, environmental engineering, biomedical engineering, chemical engineering, and

> aero engineering, those [all have] single disciplinary [capstone] design projects. The team is going to be made up almost exclusively of Aeros, or Environmentals, or Civils, or whatever. So, immediately they are violating [that outcome]; they are not multidisciplinary designs.
>
> This has almost never been a problem from ABET, because the ABET PEVs are from schools, like [ours], and they say, "OK, so we understand what you're trying to do." So, schools weren't getting hit, but it's always been a Sword of Damocles hanging over their head. Who's going to clip the hair? So, that was something that these schools have been complaining about for years. So now, it's been changed to, "OK, the designs aren't necessarily multidisciplinary, but they are large complex systems that you can maybe argue are multidisciplinary or not." [Then] there's no question there.
>
> *(Associate dean, private engineering school)*

EC 2000's well-intentioned requirement for students to experience multidisciplinary teams was in fact in conflict with the institutional structures and available resources at most engineering schools. As a consequence, many PEVs, who most often were also engineering faculty and therefore familiar with this constraint, resolved the tension by looking the other way. However, a particularly dogmatic evaluator, one who believes, as this interviewee does, that multidisciplinary experiences dominate the engineering world, could have cited the program for a shortcoming based on its lack of compliance with a mandated outcome.

In the context of wanting to minimize the tensions that arise between ABET's published criteria and how they're interpreted in practice by the programs undergoing evaluation and the PEVs, the Criterion 3 & 5 revisions that were discussed, debated, and implemented several years ago makes sense [18, 26]. From an operational standpoint, if programs consistently misunderstand a particular criterion (or learning outcome), or collectively resist them, it was organizationally necessary to adjust the criteria to conform to established practice, at least where further improvements to PEV training could not produce more consistent evaluation outcomes. This was especially relevant to situations, such as with the multidisciplinary team experience requirement discussed above, where PEVs were regularly evaluating programs in ways that were at variance with the published criteria; ignoring criteria that they felt were too burdensome if interpreted too narrowly; or where they felt they were unequipped to pass judgement. ABET's legitimacy depends on delivering consistency, lest programs or institutions accuse ABET of being inconsistent. In this sense ABET remained, and remains accountable to the conduct of U.S. academic organizations and their own PEVs. For those who worked on the 2018 changes to the criteria, this may have meant letting go of some of the goals that had been a part of EC 2000. But neither could ABET afford to have an accreditation standard that couldn't be consistently applied and enforced, or which resulted in the non-accreditation of programs many considered to be strong programs.

That said, our data pertaining to visits that occurred both before and after the 2018 criteria changes suggest that inconsistent evaluations do remain endemic to ABET accreditation, for two reasons. First, PEVs were explicitly granted independent judgment under EC 2000. In going from several pages of detailed curricular specifications to more simple language for math and

science and "engineering topics" requirements, but as grounded by the phrases, "appropriate to the discipline" and "appropriate to the field of study," respectively, PEVs were given the nominal responsibility for judging whether a curriculum presented by a program met the expectations of their profession. And here EC 2000 offered no further guidance. The societies that tried to offer their evaluators guidance on how to think about what was "appropriate" to their discipline and field of study—beyond what was allowed under program criteria—were in fact the ones labeled as pushing shadow criteria that had not been reviewed and approved by ABET. (Admittedly, such guidance was likely also shaped by professional interests.)

Perhaps more importantly, outcomes assessment, as implemented under EC 2000, was quite different from outcomes assessment as it came to be practiced in the K-12 sphere. Reform initiatives in primary and secondary education, such as No Child Left Behind and later Common Core utilized neoliberal modes of governance in a more classic form. State Ed departments often specified the desired learning outcomes in detail, and stipulated the exact metrics and assessment methods that schools had to use to demonstrate compliance. Assessment in K-12 was and continues to be conducted primarily through standardized testing. Standards of performance have therefore been tagged to very specific measures of proficiency, with specific incentives and disincentives offered to schools who either meet or fail to meet expectations [27].

By contrast, EC 2000's architects allowed, and indeed required programs to define their own program objectives and to develop their own assessment strategies. This was driven by general assumptions about academic freedom. But it also built on a desire to cultivate educational innovation. And here, there was a semantic slippage. While economic globalization may have required U.S. higher education to become more responsive to market forces, and to produce a more diverse STEM workforce than one driven by a Cold War commitment to the engineering sciences, flexibility in the criteria alone would have accomplished this goal. However, for EC 2000's designers, who were themselves steeped in a culture of innovation, building a diverse STEM workforce that would contribute to an innovation economy carried over into the idea that engineering education itself had to be innovative. As a consequence, ABET has resisted any attempt to develop standard approaches to assessment, even though they recognize that there are best practices. ABET holds an annual symposium in part to share such best practices and highlight innovations in assessment methods.

ABET specified the learning outcomes it hoped to see under Criterion 3, but it specified neither the metrics nor the methods through which assessment had to occur. From the standpoint of neoliberal governance, this significantly limits ABET's capacity to control learning outcomes. Indeed, ABET's value proposition—the ability to grant or withhold accreditation—provides none of the fine-grained incentives that State Ed departments use to push primary and secondary schools, and now some public university systems, to strive for performance gains. While the graduated system of shortcomings—concerns, weaknesses, and deficiencies—translates into some measure of more detailed control, they come across as punishments exacted through faculty time, which again is a scarce resource on campuses today. Even when effective, such an approach to dealing with shortcomings will not be popular. Nor are the penalties easily calibrated in ways that would translate into an obvious system of incentives and disincentives that are transparent enough to drive changes in behavior.

This problem of achieving calibration in the evaluation outcomes stands at the heart of ABET's challenge with consistency. The bottom line is that ABET cannot afford *not* to accredit more than a handful of programs that faculty across the country think of as strong programs because doing so may damage ABET's credibility more than the institutions whose reputation may exceed their own. The entire graduated system of shortcomings and the "due process" editorial reviews, which existed prior to EC 2000, are designed to allow the accreditation commissions and their members to calibrate their own PEV's evaluations to ensure that every punishment matches the crime. Every PEV has to discuss their findings in front of the entire evaluation team, during which an effective team chair will notify PEVs of any evaluation that seems out of alignment with common expectations. PEVs are also frequently reminded by their team chair that their evaluation has to be grounded directly in the language of the accreditation criteria. If something they wish to cite a program for isn't clearly mentioned in the criteria, they bear the burden of proof for explaining why what they are asking for is a valid interpretation of the criteria under commonly accepted professional standards.

In a more nuanced version of the accreditation process provided at the start of this section, PEVs are given the authority to write up their individual evaluations, which the team chair assembles into a combined report. Each PEV's findings are also reported out to the institution in the form of an exit statement that occurs at the end of a visit, giving programs an opportunity to consider their response while the due process review unfolds. Meanwhile, two members of the accreditation commission review the "draft statement of preliminary findings," assuming the role of "Editor 1" and "Editor 2," in order to make sure that each report conforms to their expectations of what needs to be enforced. This also serves as a check to make sure that the team chair has played their part in producing a fair and consistent set of evaluations, both across the different programs evaluated during a visit, and for comparable programs across different accreditation visits. Thus, in the example above of "multidisciplinary team" experiences, the EAC commissioners will have likely edited out shortcomings that are based on a narrow or "dogmatic" interpretation of the outcome, especially if the program under review offered their own interpretation of the learning outcome and what they aimed to assess that the commissioners found to be generally acceptable. The programs are then given an opportunity to respond to the draft report, either by describing changes that they made in response to the information provided at the exit meeting, or by submitting additional evidence or data in the manner of an appeal. (Formally, appeals only occur after the final decision.) While theoretically, a shortcoming may be shifted upwards—a concern turned into a weakness, or a weakness into a deficiency—it's far more common for a negative evaluation to be modified downwards before the final recommendations of the commission are advanced to the Board of Delegates for their review and decision [15, 28]. Altogether, this well-developed bureaucratic activity serves as a norming process where aberrant evaluators are brought in line with the expectations of the majority.

There is also a tension that results from the fact that most PEVs have neither the training nor background in assessment, which is at the heart of any continuous improvement regime. They therefore have difficulty interpreting the validity of assessment efforts, a difficulty compounded by the fact that while ABET tells programs to assess student learning, it has not specified how much assessment is required, or the extent of the changes and improvements that has to occur during each review cycle. This can lead to mis-calibration among the PEVs, and misalignment

between a PEV and the program they are reviewing, unless the PEV has been on many visits and has the relevant information and social cues on how to avoid being labeled a maverick evaluator.

That said, we have also heard that ABET has had to temper this norming process due to the challenges of volunteer recruitment. Especially for those who volunteer to become PEVs out of their desire to make a difference, having the ABET commissioners edit their recommendations too often or too significantly can take the wind out of their sail. While we cannot disclose the source due to confidentiality, anecdotally this is also said to be a concern that limits the extent to which ABET is able to bring consistency to its program evaluations.

Conclusions

Although we organized this paper around the phenomenon of maverick evaluators, we suggest that the variance that occurs with ABET program evaluation has underlying structural causes. ABET's move away from quantitative criteria, during an era of rising concerns about economic globalization, resulted in a more flexible set of accreditation criteria that gave PEVs nominal responsibility for evaluating programs based not only on the published criteria, but the accepted standards of their profession. EC 2000's call for outcomes assessment, initially not only for ABET's mandated learning outcomes, but those developed by a program in relation to their program education objectives, also introduced new assessment practices that most ABET PEVs had neither the background nor training to reliably oversee. Nor have the assessment methods and metrics been specified precisely enough even for PEVs with significant training in assessment to routinely apply during their evaluation of a program.

This has left ABET with no choice but to continue employing an editorial process to reign in their own PEVs in an attempt to produce consistent evaluation outcomes. In addition, whatever aspirations ABET had to align the time and effort that faculty and administrators devote to accreditation with a continuous improvement philosophy, the value proposition of accreditation is such that there is no easy way to come up with a set of incentives and penalties that compels programs to engage fully and meaningfully with this aspect of ABET's accreditation process. This leaves ABET commissioners in the position of having to accept that their criteria are primarily about minimum standards; and that aberrant evaluations that result from an individual evaluator's attempt to assert a stronger professional standard need to be edited down to meet accepted practices. In response to the tensions revealed by their own maverick evaluators, ABET has experienced pressure, as an organization, to define the enforcement of accreditation criteria, and the accreditation criteria themselves around the educational practices that already exist within the programs that they oversee.

The aim of this paper has been to identify some of the limitations of engineering accreditation as practiced in the United States through a close study of ABET's maverick evaluators. Our larger study looks more systematically at how U.S. academic institutions of different types and rank responded to EC 2000 and how they approach their accreditation visits today. We expect to report on those findings in a separate publication. Until we complete that review of our data set, it would be premature to provide definitive recommendations about the options available to ABET, its volunteers, and the programs that make use of their services. Based on the findings of this paper, we offer the following, preliminary recommendations:

- ABET management: Given their own commitment to continuous improvement, we suspect that ABET's administrators are already reasonably aware of the findings in this paper. Their challenge exists in the historical decisions that were made about how to approach engineering accreditation, and their resulting reliance on volunteers. ABET already monitors PEV performance, has done what it can to improve their training programs, and has developed and continues to refine their process for ensuring consistency in their evaluation outcomes. That said, because of the implicit incentives that exist for academic organizations and their faculty to hide their frustrations with an accreditation organization, if any of the views captured in this paper, and in our future work, point to concerns that are not so familiar to the organization, we would recommend that ABET reflect on the concerns that are being expressed, and their implications. There may be ways to modulate PEV and team chair training, or the communications that occur with institutional representatives and the member professional societies that would help calibrate PEV expectations and performance further.

- Engineering Accreditation Commission (EAC) / Team Chairs: Being themselves a group of volunteers, we're less certain of the ways in which the EAC and its individual team chairs understand ABET's mission, and the tensions espoused by its volunteer based approach to accreditation. A review of the findings from this paper may suggest specific changes in team chair orientation, how the EAC should weigh the tradeoffs between academic freedom and flexibility, on the one hand, and the efficacy of providing more definite metrics for outcomes assessment and meaningful targets for continuous improvement. The question of whether eleven, or even seven outcomes can be assessed by every program in meaningful ways was apparently raised during the Criterion 3 and 5 revisions made several years ago. It may be that this remains a live issue for the Commission. The EAC may wish to grapple with the possibility that the present editorial process associated with the due process review may be encouraging programs to adopt a more compliant attitude towards accreditation.

- Program Evaluators (PEVs): As volunteers, experienced PEVs should help spread the word about their role inside ABET. This role is already clearly defined in the material ABET prepares. The material makes it clear that PEVs are expected, first and foremost, to contribute to quality assurance by adhering closely to ABET's published criteria. They are also encouraged to assist the programs they review to strengthen their own capacity for continuous improvement. PEVs, by contrast, are not expected to interject their own ideas about what constitutes a strong academic program. And despite language to the contrary, PEVs are not expected to exercise too much discretion in their judgments about what constitutes acceptable professional and disciplinary standards for each outcome and criteria, but to calibrate their judgments through an awareness of their peers and their approach to evaluation. When uncertainties about how to evaluate a program arise, new PEVs should be willing to consult with other members of their evaluation team, as well as other PEVs from their own professional society.

- Institutional Representatives: Associate deans and others who serve as ABET coordinators at school and department level should use this paper to calibrate their own

expectations about an ABET visit. They should make sure they understand, as explained during training, that quality assurance stands at the forefront of an accreditation visit, and that programs are expected to first demonstrate compliance with all published accreditation criteria before focusing on what is strong or unique about their program. This does include a commitment to continuous improvement through assessment. While every assessment coordinator, program faculty, and institution may choose to do more, this should be clearly marked within the self-study as an additional activity (especially if the effort, such as a curriculum change, is not based on assessment) so that it's not confused with the data that must be presented to demonstrate compliance.

Programs and their coordinators should also be aware of the fact that aberrant evaluations will sometimes arise, especially when a program is assigned a new PEV who is not yet accustomed to carrying out a review based on the exact wording of the accreditation criteria, or through unwritten standards about how they ought to be interpreted and enforced. While an unexpected shortcoming may be upsetting, effort should be made to first confirm that the misunderstanding wasn't on the part of the program itself. Then, by understanding the typical ways in which aberrant evaluations occur, programs can offer more coherent rebuttals during the exit meeting, or else in their due process response. In ways that we were not able to address in this paper because of our specific focus on maverick evaluators, the flexibility afforded by ABET's current approach to assessment does also provide opportunities for programs to embrace continuous improvement in a more robust way, and assess their own performance vis-à-vis learning outcomes that are and aren't mandated under Criterion 3. Such assessments can count towards the continuous improvement and assessment requirement mandated under Criterion 4, but this approach should be carefully explained to evaluators who may not have yet experienced a program that utilizes outcomes assessment at this level. The value of this last recommendation will be more evident in our other paper where we address more systematically the different ways in which U.S. colleges and universities have engaged with ABET's accreditation requirements.

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