Rethinking ABET Accreditation of Computer Science Degree Programs

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Abstract

This paper examines a number of alternatives for improving the Computer Science accreditation process. The specific focus of the paper is on the accreditation process sponsored by ABET -- the Accreditation Board for Engineering and Technology.

The paper considers alternatives for ABET accreditation on a four-level spectrum. The most radical alternative is a Computer Science degree program with no ABET accreditation at all. On the opposite end of the spectrum is the ABET status quo, with a fully accredited degree program. At each alternative level of the spectrum, the paper discusses the pros and cons relevant to that level. Where appropriate, the paper makes concrete experience-based suggestions for how specific aspects of the accreditation process could be improved.

1. Introduction

ABET (the Accreditation Board for Engineering and Technology) is a large and very well known agency for the accreditation of post-secondary degrees. At present, ABET accredits approximately 3,700 programs at over 750 colleges and universities in 30 countries [3]. Computer science and software engineering degree programs are among those accredited by ABET.

There is agreement in the computer science education literature that ABET accreditation can be a time-consuming process, with mixed results for computer science programs [5,8,10,11,12,15]. We have certainly observed these issues at our own institution, as presented in Section 2 of this paper.

Given these initial observations, the motivation for this paper can be summarized in three points:

- the ABET process can be time-consuming
- the ABET process has mixed results, some positive and some negative
- a large number of educational institutions participate in the ABET process

For the first two of these points, we have specific experience at our own institution to substantiate them. There is also evidence in the computer science literature to support these points. For the third of these points, if our experience is representative of other institutions with ABET-accredited computer science programs, then the observations made in this paper may be of some interest to them.

With the preceding three points in mind, it is reasonable to consider some ways to reduce the amount of time spent on ABET accreditation as well as to increase the benefits that the process produces. After providing some background data, this paper presents four possible alternatives for improving the ABET process.

2. Background

Our department offers degrees in both computer science and software engineering. Both of our degrees are accredited by ABET, and have been so for at least two ABET 6-year evaluation cycles. The primary focus of this paper is on accreditation of computer science, but issues from software engineering accreditation will also be taken into consideration where appropriate.

Nationally there are a large number of computer science and software engineering degree programs that are ABET accredited. As of this writing, there are 287 four-year degree programs in computer science that are accredited by ABET in the United States [1]. For software engineering, there are 26 such programs [1].

It is difficult to obtain a precise national estimate of the percentage of computer science programs that are accredited compared to those that are not. In the state of California, in which our own institution resides, this percentage can be more accurately determined. Given the size and diversity of the state, it is reasonable to consider it to be a representative example of ABET accreditation in computer science. This paper makes no attempt to extrapolate ABET data from the state of California to the nation as a whole. Rather, it views California as a sizeable geographic area from which to gather some useful data. The California state university system is noteworthy in this regard since it is the largest four-year public university system in the United States.

There are two 4-year public university systems in California: the California state university (CSU) and the university of California (UC). The CSU is a predominantly undergraduate system, with a majority of the campuses offering masters degrees in a variety of fields. The UC is a research-oriented system, with campuses offering undergraduate, Masters, and PhD degrees. Except in cooperation with certain UC campus or in other special circumstances, the CSU campuses do not offer PhD degrees.

In the CSU, 22 of the 23 campuses offer a degree program in computer science [7]. Of those 22 programs, 12 of the programs are ABET accredited [1]. At the UC, 9 of the 10 campuses offer a CS degree, of which 6 programs are ABET accredited. Overall, for public 4-year universities in California that offer a computer science degree, the degree is ABET accredited at approximately 60% of the campuses.

There are approximately 50 private 4-year universities in California that offer a computer science degree [16]. Of those, only 4 are accredited by ABET [1]. This means that 8% of private 4-year computer science degrees in California are accredited by ABET.

There are presumably a wide range of reasons that a computer science program would choose to forgo ABET accreditation. A detailed discussion of these reasons is beyond the scope of this paper. What is of note here is that a substantial fraction of 4-year California universities choose not to be ABET accredited. Hence for whatever reason(s), non-accreditation is considered a viable option for those universities, either by explicit choice or for some other reason such as insufficient resources to devote to ABET.

Conspicuously missing from the list of ABET-accredited private universities are a number of schools that regularly appear on lists of top computer science programs in the country, for
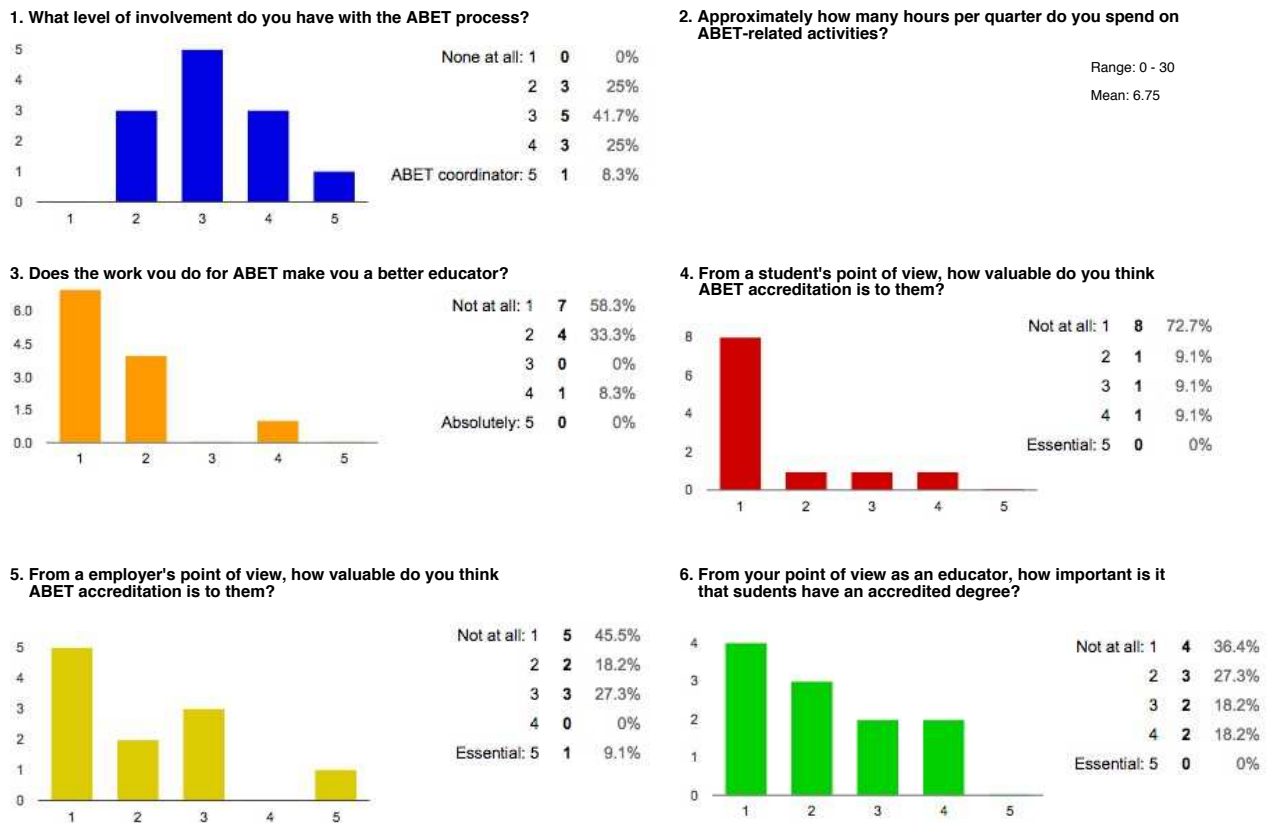
example the list in [6]. Noteworthy universities in this category include the California Institute of Technology, Stanford University, and Harvey Mudd College.

2.1. Department Survey

To gather specific data on the importance of ABET accreditation for our department, we conducted two surveys. The first survey was with our 18 faculty members. Figure 1 shows the questions and results of the survey, along with some analytic data on the results.

The survey results can largely speak for themselves. Overall the results can be characterized with these high-level points:

- There is a reasonable level of involvement among faculty in the ABET process.

1. What level of involvement do you have with the ABET process?

None at all: 1	0	0%
2	3	25%
3	5	41.7%
4	3	25%
ABET coordinator: 5	1	8.3%

2. Approximately how many hours per quarter do you spend on ABET-related activities?

Range: 0 - 30

Mean: 6.75

3. Does the work you do for ABET make you a better educator?

Not at all: 1	7	58.3%
2	4	33.3%
3	0	0%
4	1	8.3%
Absolutely: 5	0	0%

4. From a student's point of view, how valuable do you think ABET accreditation is to them?

Not at all: 1	8	72.7%
2	1	9.1%
3	1	9.1%
4	1	9.1%
Essential: 5	0	0%

5. From a employer's point of view, how valuable do you think ABET accreditation is to them?

Not at all: 1	5	45.5%
2	2	18.2%
3	3	27.3%
4	0	0%
Essential: 5	1	9.1%

6. From your point of view as an educator, how important is it that sudents have an accredited degree?

Not at all: 1	4	36.4%
2	3	27.3%
3	2	18.2%
4	2	18.2%
Essential: 5	0	0%

Figure 1: Faculty Survey.

- All but one of the responding faculty think that ABET is of little or no value to them as educators.

- A substantial majority of faculty think that ABET is not of value to students, from the students' own point of view.

- More than half of the faculty think that ABET is of little or no value to employers and it is of little or no importance for students to have an accredited degree.

2.2. IAB Survey

The other survey we conducted was with our 38-member industrial advisory board (IAB). The response rate for the IAB was 22 out of 38, for 58%. Figure 2 shows the questions and results of this survey.

The opinions of IAB members were notably more positive than faculty about the importance of ABET accreditation. A high-level characterization of these results is the following:

- A majority of employers think it is important or essential that their employees come from an accredited program, for both computer science and software engineering degrees.

- 40% of employers say that an accredited degree makes a difference in the salary that will be offered to job applicants.

- A majority of employers say that an accredited degree does not make a difference in promotion opportunities.

- Employers are entirely mixed on the question of there being a difference between employees with or without an accredited degree.

In general, employers found ABET accreditation to be more important than did faculty. However, the results of the IAB survey do not show a resounding endorsement for ABET.

2.3. Findings at Other Universities

As noted in the Introduction of the paper, there is some agreement in the computer science education literature that the ABET process is complicated and time consuming. This is noted explicitly in [5,8,10,11,12,15]. The following are relevant quotes from these articles:

- In [5], Booth says "Preparing for an accreditation visit is generally viewed as a huge task."

- In [8], Carey says "Much of the material was routine but it took a tremendous amount of time to gather and organize."

- In [10], Fu says "It is important to note that the process of program assessment and quality assurance is an endless loop. It requires a substantial commitment from the faculty and the administration to keep the process moving forward."

- In [11] Leach says "Is the ABET accreditation process complex, but beneficial? There is strong agreement that it is complex. The nature of the benefits may vary, depending on the type of institution."

- In [12], Liu says "ABET is an important accreditation, but the preparation process is very

1. For your employees with degrees in computer science, how important is it that they come from an ABET-accredited program?

Not important at all: 1	4	18.2%
2	0	0%
3	7	31.8%
4	8	36.4%
Essential: 5	3	13.6%
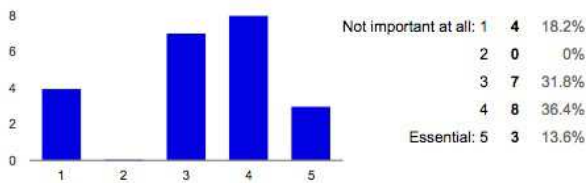
2. For your employees with degrees in software engineering, how important is it that they come from an ABET-accredited program?

Not important at all: 1	4	18.2%
2	0	0%
3	6	27.3%
4	8	36.4%
Essential: 5	4	18.2%
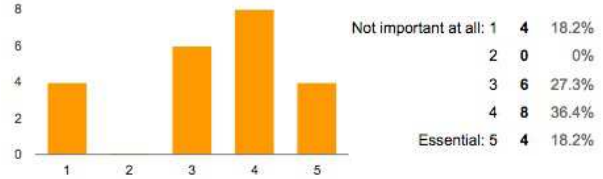
3. Does a degree from an accredited program make a difference in the salary that will be offered to an applicant being considered for employment?

Not at all: 1	4	18.2%
2	2	9.1%
3	7	31.8%
4	8	36.4%
Definitely: 5	1	4.5%
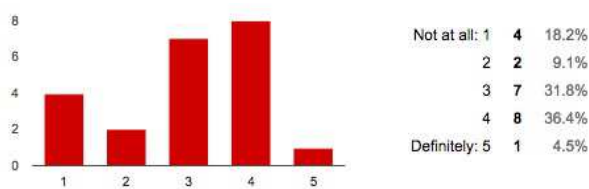
4. Does a degree from an accredited program make a difference in promotion opportunities within your company?

Not at all: 1	10	45.5%
2	4	18.2%
3	7	31.8%
4	1	4.5%
Definitely: 5	0	0%
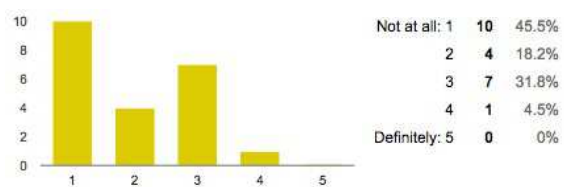
5. Among the employees you have hired, have you observed any difference in job preparation and skills between those who come from accredited versus non-accredited programs?
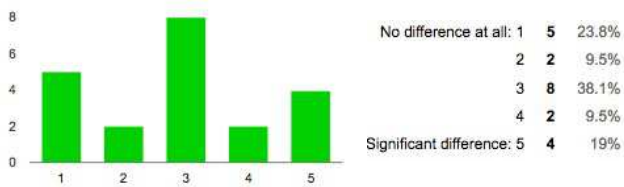
No difference at all: 1	5	23.8%
2	2	9.5%
3	8	38.1%
4	2	9.5%
Significant difference: 5	4	19%

Figure 2: IAB Survey.

time-consuming and lacks guidance."

- In [15] Sandersen says "The changes to the ABET-CAC assessment criteria are significant, and most programs are going to have to revise their assessment plans before their next visit."

A majority of the literature reports on ABET accreditation conclude the beneficial results of the ABET process justify the time and difficulty of conducting the process. All of the papers that conclude thusly are by authors from departments that have successfully gone through the process.

As noted in Section 2.1 of the paper, there are a large number of computer science degree programs that are not ABET accredited. For those departments, the faculty have decided for one reason or another that the benefits of ABET are not worth the difficulties or that they do not have the resources to conduct the process even if they see the benefits.

3. Improving the ABET Process

The preceding section presented data that indicate ABET accreditation is time consuming and can offer mixed benefits to departments with computer science degrees. As such, it is reasonable to consider how the process might be improved to make it easier and more beneficial.

The alternatives for improvement are presented at four levels

1. "improve" ABET by eliminating it
2. consider substantive changes to the ABET process
3. consider less substantive clerical changes to the ABET process
4. leave ABET as is, with whatever improvements the ABET organization implements

3.1. Improvement Alternative 1 -- No ABET At All

The first alternative for "improvement" to ABET accreditation is to eliminate it altogether. As noted earlier, this approach is taken by a substantial number of Computer Science departments already. The reasons for opting out of accreditation are not always stated explicitly. Based on the research discussed in Section 2 of this paper, a number of universities may simply not have the resources to dedicate to the time-consuming process or they have found the cost/benefit ratio to be too high on the cost side.

A notable case where a university clearly states its reasoning for not pursuing ABET accreditation is the Stanford University Computer Science Department. At their department website, on the page titled "Considering CS?", they state that ABET accreditation "... has no practical significance whatsoever in computer science" [17]. This is the position of several faculty in our own department, in particular those who answered "Not at all" to questions 3 through 6 in the survey of Figure 1.

Stanford could be considered a special case with regards to ABET accreditation, given its reputation as one of the top CS departments internationally. In light of this reputation and the unquestioned merit of its graduates, Stanford's choice to forgo ABET accreditation may not be a viable option for other departments with lesser reputations or for whom other circumstances dictate that ABET accreditation must be pursued. In our case for example, such "other circumstances" come in the form of a non-negotiable mandate from the college of engineering that all of its departments must be accredited.

In a private communication, the Associate Chair for Education in the Stanford Computer Science Department stressed that their decision to forgo ABET accreditation is indeed due to their unquestioned reputation among those who hire their students [14]. He stressed that they have found for Stanford CS students, ABET accreditation provides no practical significance. He added that is not to say that ABET has no practical significance for other programs.

Hence, as an entirely practical matter, forgoing ABET accreditation may not be an option for schools with reputations that do not match Stanford, which is to say most schools. This being the case, it is reasonable to consider some ways that the ABET accreditation process could be

made less onerous, for departments such as ours where many faculty find it to have little or no value.

3.2. Improvement Alternative 2 -- Fundamental Change to the ABET Process

For those institutions that choose to forgo the ABET process, it could be that a process with a different and simpler structure might work for them. A key aspect of such simpler process would be in the area of student assessment. Specifically, the evaluation process would not require a program to produce other forms of student assessment than those already produced by faculty in the classes they teach. The process would also not require much of the other forms of documentation typically produced for an ABET self-study report.

As currently structured, the core of the ABET assessment process is a small number of student learning outcomes. These are generic high-level statements of what students should learn in a degree program. ABET provides its own set of outcomes, but allows programs to devise their own. Once outcomes are established, ABET requires programs to use assessment and evaluation processes that measure how well the outcomes are attained by students. ABET further requires that a program to demonstrate how its curriculum is consistent with theses outcomes [2].

A fundamental problem with this process structure is that it may not be a useful or meaningful way to perform assessment. Many faculty in fact question the utility of an assessment process that is different from and in addition to the student assessment they already perform in their classes [13].

Furthermore, the assessments made as part of the ABET process are often based on assessment data that come directly from classes. In order to be used as part of the ABET process, these data need to be reformulated to suit the outcomes-based process structure. In this context, it is not surprising that faculty question why this extra effort is necessary.

In addition to outcome-based assessment, ABET also requires evidence of "continuous program improvement". This again is an area where faculty are generally continuously at work. The work takes such forms as

- introduction of new courses with evidenced-based assessment plans to determine the quality and efficacy of the courses
- publication of findings about our courses in peer-reviewed research venues
- continuous consultation with student and employer constituents to determine areas of improvement on which to focus

While some or all of this work can be used in an ABET report, it often requires substantial additional effort to reformat into a form that is acceptable to ABET.

Given these observations, a suggestion for fundamental change to the ABET process is to eliminate altogether the current form of outcomes-based assessment. In its place would be a evaluation process similar to how graduate degree programs are often evaluated. The author of this paper has participated in several graduate program evaluations, which have the following general structure:

1. The program being evaluated produces a modest-sized summary of its degree, providing references to outside sources to which the evaluators can refer.

2. The program itself chooses two or three outside experts to perform the evaluation. The experts are typically faculty from similar institutions to the one being evaluated.

3. The evaluators read the report, study the other relevant materials, visit the campus, meet with appropriate stakeholders, and deliver a report of their findings.

3.3. Improvement Alternative 3 -- Simpler ABET Changes

The fundamental changes suggested in the previous section are a lot to ask. Short of such changes, there are a number of simple and essentially clerical changes that ABET could make to decrease the complexity and volume of what must be reported to them. Also suggested are changes in the style of an ABET evaluation that could make the process more collaborative and useful to all parties concerned.

The following is a short list of such changes:

• Eliminate from the self-study large portions of institutional reporting that could easily be accessed by following links to existing online sources.

• Have the conduct of the accreditation process be far more open and transparent; at present there are seemingly arbitrary rules about when and with whom communication can occur between a program being evaluated and ABET.

• Structure ABET visits more in the form of a collaborative discussion between like-minded educators and less like a fault-finding audit; at present the findings of ABET visits can be surprising and sometimes find fault with insignificant aspects of the ABET report that were entirely unexpected.

Interestingly, the author of this paper does not feel at liberty to provide concrete examples of the last two of these points given the confidentiality limitations that surround what parts of an ABET report and the evaluator findings can be shared outside of the department. This is one of the very things that we suggest be changed.

3.4. Improvement Alternative 4 -- the ABET Status Quo

The final alternative for improvement is to leave matters entirely up to ABET. The ABET organization does continually propose improvements, such as those currently under review for student outcome and curriculum criteria [4]. Based however on ABET's history, improvements such as those suggested for levels 1 through 3 above seem unlikely to originate from ABET.

A close examination of the changes cited in [4] is not encouraging for those of us who would like to see a reduction in the complexity of ABET reporting and a decrease in the workload for producing ABET computer science reports. An ABET document described as "CAC Side-By-Side Criteria" shows significant changes to the structure of the computing accreditation criteria [9]. While ABET's goal may be to better organize and even simplifying the criteria, a result of these changes may well be to add to rather than reduce the amount of effort it takes to produce an

ABET report. Specifically, all of the criteria on which the previous-cycle reports were based at our institution may have to change substantially to coincide with the new criteria. This is another example of work to be done that is of no meaningful benefit whatsoever for the department's educational mission.

4. Conclusion

This paper has presented some relevant data on the ABET accreditation process that indicates that changes could be made to the complexity of the process and to the benefits that the process affords to those who pursue it. Four levels of changes were suggested and described.

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