

## **Designing an ABET-ready Computer Engineering Program in a Medium-Sized Liberal Arts College**

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## Abstract

While most engineering students aspire to graduate from a top engineering university, many choose to attend small to mid-size liberal arts colleges for various reasons, including financial, location and learning needs. It is essential that these engineering students are given the opportunity to receive their degrees from an ABET-accredited program as many employers specify this as a minimum education qualification. However, engineering programs in liberal arts colleges face many challenges, especially recently-launched ones, from limited financial support, facilities, external partnerships and support, program marketing, and student enrollment and retention. This paper presents a model for a cost-effective, efficient and timely way of getting the engineering program ABET-accredited. Most existing works on ABET Accreditation for ECE programs have focused on programs residing in large public or private universities, and those in technical-focused institutions, often with dedicated engineering colleges or departments. These programs typically do not face the same unique challenges that engineering programs within liberal arts colleges face. The paper focuses on the initial accreditation of a Computer Engineering program.

## I. Introduction

With the demand for STEM skills and expertise ever increasing, more and more liberal arts colleges are offering programs in these areas. While these colleges have traditionally offered programs in the sciences, engineering programs are relatively new for many of these institutions. As a result, many institutions face the challenge of undergoing preparations for initial ABET accreditation without much in-house knowledge, infrastructure or expertise about the process to begin with. This is compounded with the fact that often, when something new is undertaken, much time is taken up with acclimation and the uncertainty of how to get started.

Engineering programs within liberal arts colleges face unique challenges in that resources are generally limited. Moreover, teaching colleges often follow a 4-4 course teaching load (minimum of 12 credit hours per semester), and more often than not, faculty end up being overloaded due to faculty shortage. They also do not have dedicated “ABET accreditation coordinators” specifically handling the accreditation process, and this responsibility falls into one or more faculty members.

Given the obvious scarcity of financial and human resources, it is critical that the process is handled as efficiently as possible with minimum cost and minimum additional burden on the faculty members involved. In this work, we propose to apply traditional project management techniques to the accreditation process. Project management is a field that has been studied extensively but it is usually applied to large scale projects with well-defined product deliverables (e.g. software or hardware systems). We argue that the principles of project management can be reused and applied to a process where the deliverable or end product is less tangible, but the stakes are as high – the successful attainment of ABET accreditation status.

One of the most challenging aspects of establishing and forming a program that is ready for accreditation is faculty buy-in. Take for example one of the most important areas of program continuous improvement - the assessment process. Assessments are best performed by the

instructors who teach the courses themselves since they have the most knowledge about student performance and improvement pathways. However, faculty members have traditionally enjoyed more independence than many other employment sectors, hence, it is generally not possible to “order” faculty to submit much-needed assessment data when requested. Moreover, faculty from teaching and research colleges alike are constantly handling multiple commitments at once. Another reason is that faculty members generally operate on their own time. There is no dedicated 9-5 hours where everyone needs to be in the office, and one can request deliverables in person.

For faculty to be most efficiently integrated into the assessment and accreditation process, these processes must be as seamlessly integrated as much as possible into their daily commitments, resulting in minimal disruption to their normal operation. For mid-sized liberal arts teaching-focused colleges looking to expand into engineering disciplines, this means that assessment and accreditation should not impose a daunting additional amount of time investment from faculty. In this paper, we propose a model for accomplishing this while at the time, addressing the cost-effectiveness, efficiency and timeliness of obtaining initial accreditation.

## **II. Timely Accreditation Model**

Our approach is underpinned by four key principles

1. Target-driven
2. Application of project management principles
3. Leveraging as automation and tools as much as possible
4. Amortization and distribution of work

The last three principles are quite straightforward and may be viewed as common sense, however, the first principle may diverge from current prescribed best practices. It has long been advocated that accreditation and assessment should be by-products of good practices and processes rather than the main objective for designing the program. However, in small to medium liberal arts colleges, especially those with limited exposure to engineering programs and engineering accreditation, “getting started” is often the biggest hurdle. There is often no in-house expertise and likely, the engineering program(s) is(are) newly-established. In this case, we argue that it is more efficient to design the program with the specific objective of obtaining accreditation. The student outcomes, general and program criteria, as well as the Program Evaluator Worksheet items [5] are all products of extensive research and inputs from the most qualified engineering program designers in the world. Leveraging such resources from the perspective of a non-engineering institution with limited resources is therefore practical. The approach is akin to “reverse engineering” a system in order to obtain inputs and understand processes.

In the following sections, we elaborate on each of these principles.

### **A. Principle #1: Target-driven**

We start with the Program Evaluator Worksheet (PEV worksheet), the first few rows of which are shown in Fig. 1. This worksheet is published in the Accreditation Criteria and Supporting

Documents of the ABET website [5] and is used by program evaluators to assess the program based on the self-study, and during the campus visit. The “target-driven” part of principle #1 sets each row of the worksheet as a target for which the program is designed to attain.

ABET Engineering Accreditation Commission						
E341 PROGRAM EVALUATOR WORKSHEET						
NOTES: 1) Make entries into grey areas only; 2) click on cells for dropdown menu for D,W,C, or R (resolved); 3) remove a D, W, C, or R by using <delete>						
HINT: Type Alt-Enter (Windows) or Ctrl-Option-Enter (Mac) to get a new line in the same cell						
Name of Institution						
Program Name					PEV	
Team Chair					Visit Dates	
Enter “C” for concern, “W” for weakness, “D” for deficiency, and “R” if issue has been resolved						
Pre-visit Day 0 Day 1 Exit Statement Comments						
“X” will appear on this row if no Deficiencies or Weaknesses						
I. STUDENTS						
Evaluate student performance						
Monitor student progress						
Advise students regarding curricular and career matters						
Have and enforce policies for accepting both new and transfer students						
	X	X	X	X		

Figure 1: Program Evaluator Worksheet

To create a target-driven program, the following are established for each criterion, which can be viewed as a group of worksheet items or targets – needs, cycle and tasks.

Identification of needs is one of the earliest steps in the program’s preparation for accreditation. It is important to first understand existing infrastructure and resources, and what needs to be procured. Additionally, it is critical to get an idea on how much time is needed to put additional infrastructure in place. As will be discussed further shortly, we use the principles of Project Management to identify dimensions that need to be considered. Project Management principles identify integration, scope, time, cost, quality, procurement, human resource, communication, risk and stakeholder as the primary areas that need to be addressed. For scope, we use the PEV which gives a clearly defined set of objectives and clarifies the scope for addressing each self-study criterion. This worksheet additionally helps identify time and cost needs.

Fig. 2 below shows part of the PEV worksheet adopted to help identify time, cost, human resource and communication needs. Any scheme for annotation can be used that works for the program and faculty members. In our case, we adopted several markers and indicators to distinguish between categories for each area. For example, a two-type scheme (x, y) is adopted for “Time” where x indicates minimum setup-time for addressing issues identified for that area, and y indicates the cycle time in which the item periodically evaluated to determine sufficiency. The added benefit is that this embeds the “quality management” area into the time management.

	P - process/infrastructure need to be established	Time	Cost	Human Resource	Communication	Comments
1						
2						
3	<b>1. STUDENTS</b>					
4	Evaluate student performance					In Criterion 4: Continuous Improvement
5	Monitor student progress					In Criterion 4: Continuous Improvement
6	Advise students regarding curricular and career matters	(1, 1)		E	(C, D, I)	<ul style="list-style-type: none"> <li>•Establish process for advising</li> <li>•Evaluate if faculty and career service personnel enough</li> <li>•Establish a way to share advising notes (DegreeWorks)</li> </ul>
7	Have and enforce policies for accepting both new and transfer students	(1, 1)		E	(A, C)	Communication with Admissions/Registrar and program director/department chair
8	Have and enforce policies for awarding academic credit for courses taken at other institutions	(1, 1)		E	(A, C)	Communication with Admissions/Registrar and program director/department chair
9	Have and enforce policies for awarding academic credit for work in lieu of courses taken at the institution	(1, 1)		E	(A, C)	Communication with Admissions/Registrar and program director/department chair
10	Have and enforce procedures to ensure and document that students who graduate meet all graduation requirements	(1, 1)		E	(A)	No additional management - university uses DegreeWorks

Figure 2: PEV Workbook Adopted for Identifying Areas of Management

In the table above, it can be seen that the worksheet item for criterion 1 “Advise students regarding curricular and career matters” would need at least one year to identify weaknesses and establish processes if needed, and it is reevaluated every year. There is no additional cost since the university already uses an application called “DegreeWorks” where advising notes can be inputted and keeps track of graduation requirements. If costs were identified, our scheme labels it as L, M, or H for low, medium or high cost respectively. For the human resource column, we identify E or H, where E indicates existing personnel while H indicates a new hire is needed to handle the item. Finally, in the communication area, we identify four classes, namely:

- A – an application is required to manage the item. For example, ‘A’ indicates that the DegreeWorks application is required, otherwise, the item is too difficult to manage.
- C – a communication channel needs to be established with the appropriate protocol. For example, the admissions office first check admission requirements and transfer credit of general education courses, however, the department chair or program director need to be consulted for degree-specific transfer courses and unusual cases. Both parties must be made aware who to contact in these cases.
- D – a shared documentation archive is required. For example, ‘D’ is specified for advising to share advising notes between faculty members for advising matters. In our case, DegreeWorks just happened to have a feature meeting this need, otherwise, other shared document tools such as Google Docs would need to be employed.
- I – official instructional materials are required. This means that a manual, handbook, instructional video or any other similar literature are made available as a “how-to” document that can be used as reference. For example, ‘I’ is indicated for advising to denote that step-by-step instructions on how to log and share advising notes in DegreeWorks is available.

For our ABET preparation, the process described above is repeated for each criterion in the self-study or PEV worksheet. Although time-consuming, this setup time is necessary to identify the scope and lay the groundworks for what needs to be established, procured and maintained. It is important to note that the entries above are not prescribed or claimed to be the correct designations. The method must be adopted in a way that applies to the specific program.

## **B. Principle #2: Application of Project Management Principles**

One of the key principles to our approach is the application of project management to the ABET Accreditation process. The Project Management Institute (PMI) has identified several areas of project management, including integration, scope, time, cost, quality, human resource, communication, risk and procurement management [3]. In the following sections, we discuss the most relevant areas for your purposes and discuss how they apply to program management and the accreditation process. Additionally, for each area, we provide best practice discussions on how to integrate these processes into the management of an engineering program.

### **1. Human Resource Management**

Human Resource Management is the set of processes and activities involved in organizing, leading and managing project teams [1]. Treating the human resource management as a process on its own allows administrators, faculty and staff to take steps towards ensuring that the current HR capacity is sufficient. Towards this goal, we propose to adopt project management methods to establish processes that follow the core principles of being automated, sustainable, event-driven, integrated and visible.

The first step to Human resource management is the development of a human resource plan. One of the first steps for developing the human resource plan is identifying and documenting roles and responsibilities. This is particularly critical in small to medium-sized liberal arts colleges looking to obtain initial ABET accreditation. Historically, these colleges lack in-house expertise regarding the process. Moreover, preparation ideally starts several years before the campus visit, therefore, roles such as acquiring accreditation knowledge, training, dissemination of such training are identified at the beginning.

Among the qualities of a good human resource plan are that it can determine if human resource requirements are met, how they are met, determine when they are no longer met, and has a clear plan of acquiring resources to meet changing requirements. Faculty retention is a factor that is often overlooked and not explicitly addressed. A good human resource management process will consider the retention rate of faculty and whether this number is indicative of underlying issues driving faculty to stay or leave the institution. Prescribing actions for increasing faculty retention is outside the scope of this work, and there are many resources that address this specifically [4]. We merely mention that analysis of faculty retention rate should be regularly reviewed and analyzed in faculty meetings.

### **2. Communication Management**

Communication is a major factor that can make or break organizational units of any size. The risk is particularly apparent in academia where there is a tradition of faculty autonomy, for better or worse. Faculty members are typically not beholden to strict hours where they are required to be on campus at the same time. This only emphasizes the need for an effective communication system that effortlessly facilitates collaboration and lends itself well to archiving and records-keeping. The latter requirement is significant because ABET continuous improvement guidelines encourage evaluation-based improvements implying that improvement must be accompanied by communication evidence of analysis, evaluation and actions between facilitators and, quite likely, stakeholders.

According to [3], some of the key activities to be undertaken to ensure that the communication system in place is as effective as possible are:

- *Identifying stakeholders*

Stakeholders of the program can include faculty, students, alumni and any others identified to be involved, impact or interest in the project. It is important to identify these stakeholders early on, and to make a distinction between communication management stakeholders and “stakeholders” as defined by ABET whose input are solicited to form the Program Educational Objectives. Communication stakeholders are simply those who may exchange, receive or originate any kind of communication involving relevant to the program.

- *Plan communications*

Not all aspects of the communications for the program can be planned beforehand, however, there are certain communications that should be made recurring. Tools and techniques such as automated reminders, communication templates, tagging and seamless archiving touch on the four design principles of our program management plan – automated, sustainable, event-driven and integrated. For example, events can be scheduled to automatically email reminders to attendees with little to no manual effort. Moreover, these reminders can be made recurring, a feature that supports sustainability since even if there is a change in personnel such that the person normally initiating and managing these events is no longer involved. Reminders associated with events can initially be targeted to the facilitator(s) reminding them that preparations should be made for such an event. This event-driven approach reduces active monitoring which is prone to human error.

- *Distribute information*

Two of the key principles of our proposed program management framework pertain to integration and visibility. The communication system should be deeply integrated into daily processes of stakeholders as much as possible such that they do not require significant facilitation. Additionally, visibility, if it doesn't violate privacy and confidentiality preferences, add a layer of accountability and records-keeping. For example, faculty buy-in can be encouraged by publishing due dates and a list of who has completed assigned assessments. Alternatively, task management tools such as Trello and Asana can have integrated messaging and task tracking systems

- *Manage stakeholder expectations*

An important quality of an effective communication system is that it can clearly communicate expectations and unambiguously establish severity levels of response and involvement. For example, collection of assessment data is one of the critical aspects of program continuous improvement. An effective communication channel involving this aspect can communicate this importance and the expectation that faculty response and involvement is required, rather than optional.

- *Report performance*

Status updates, reports, progress measurements and forecasts are all important communication items that would be good to integrate into the process. Such communication items further increase accountability and makes sure that no action items are lost or ignored. They also serve to establish stakeholder expectations further. For example, an action item that has multiple status reports and updates is perceived to be critical and encourages those involved to complete any pending actions.

- *Archive communication records*

Archiving communication records is critical especially in the accreditation process. Major decisions are preferably based on analysis and evaluation of data; therefore,

facilitators of the program must be able to provide evidence of communication supporting these decisions. Task management applications with integrated messaging has the advantage of automatically archiving communications that can be aggregated in the self-study report. On the other hand, keeping communication via individual email channels and threads run the risk of being too distributed and forming communication silos.

### **3. Cost Management**

Like any other public or private organization, cost need to be managed, justified, tracked and analyzed. Programs are part of a much larger entity that is the institution. As a result, the return on investment and cost-benefit relationships are challenging to track. A transparent cost management plan that is part of faculty meeting discussions is much needed in many programs, or even departments, as faculty are generally not consulted or included in the distribution of department or program funds beyond budget requests. Costs vary greatly from institution to institution. This is because some institutions already have existing infrastructure that can be used for facilitating the program, while others don't; some programs may already have the faculty and staff required, others may not. In the "Infrastructure Setup" section, we discuss a method to help identify these costs for your program.

### **4. Time Management**

The project management handbook [3] identifies the following processes involved in time management:

- *Define activities and develop schedule*

If we define the project to be the accreditation process with the ultimate deliverable being a successful accreditation without any weaknesses or deficiencies, there are several activities that can be identified to be defined by ABET itself, as well at the timeline. For example, we know that the final self-study is due on early July of the evaluation year, the draft for the readiness review should be completed at least a year before. These predefined deadlines can be used as a starting point to which program-specific activities such as assessment schedule and micro-activities such as per-semester activities can be added to.

Estimating the duration of activities should be performed during this step as well. Ideally, this step should output a time management document in the form that is employed by many project management steps such as a GANTT or PERT chart. Constraints and milestones should be taken into account in developing the schedule.

- *Estimate activity resources*

It is also useful to identify and estimate resources needed for each activity. These resources can be material, people, equipment, facilities, etc. This process also clarifies details for the cost management process.

- *Control schedule*

Once the schedule is developed and the resources identified, the most challenging part of time management is conducted, which is controlling the schedule itself. At the beginning of the process, it is important to identify the critical path. A PERT chart lends itself well to identifying this. The critical path identifies the series of activities that should be prioritized in order for the project to meet timing constraints and deadlines.

The time management process is also closely tied in to the human resource management process in that primary actors of activities must be identified as part of the schedule. This



can allow human resource shortage to be identified and assist in load balancing of tasks. Many project management applications allow activities to be assigned to persons or groups and should help facilitate this process.

## **5. Quality Management**

The project quality management can be considered to directly correspond the evaluation of program quality with respect to two main criteria – the degree at which the program meets accreditation requirements, and the degree at which the program meets stakeholder requirements. In other words, treating evaluators are stakeholders themselves with requirements that need to be fulfilled will streamline the quality management process further.

Although we believe that programs should be driven by continuous improvement goals rather than accreditation goals, accreditation efforts and processes provide an excellent framework to underpin continuous improvement on. For example, the Evaluator Worksheet is a good starting point for building a quality management plan on.

The key processes involved quality management are as follows [3]:

- *Plan quality*  
The first step to a good quality management process is identifying the qualities at which you consider the system to be in acceptable or even excellent state. Fortunately, as mentioned above, the ABET program evaluator worksheet can provide a comprehensive infrastructure for building the quality management plan into. These workbooks are published and available in the “Supporting Documents” page [5]. Additional quality metrics can be added into the worksheet such as student graduation and retention rates, average GPA, alumni employment, etc.
- *Perform quality assurance*  
A well-run program will have regular faculty and advisory board meetings. The quality assurance process can be conducted at one of these meetings at a regular schedule, e.g. at the start or end of the academic year. The quality assurance process is closely integrated with human resource, time management and communication processes in that quality assurance should be one of the key activities identified in the time management schedule, as well as the personnel identified to be responsible for quality assurance-related activities. Finally, the communication plan should include notifications on when the quality assurance is conducted. Some of the techniques that can be used for streamlining this process is making the quality assurance review a recurring event that automatically sends out reminders, as well as preparing a template similar to the program evaluator workbook that clearly lists the quality assurance metrics to be reviewed.
- *Perform quality control*  
Quality control is already performed on program delivery in the form of student assessment data. This process is extended to perform quality control on aspects of the program that have indirect effects whose impact may not be observed on student performance assessment data until years later.  
Some of the tools and techniques that can be employed in this process are cause and effect diagrams, control and correlation charts. It is also important to tie this process in with communication management by logging, approving and reviewing change requests.

## **6. Procurement Management**

Procurement in academia, especially for large investments such as hiring of faculty, can take a long time to complete, perhaps even years. Just like any other large-scale projects, it is important to define the procurement process. In many programs especially in small to medium-sized universities, procurement is mainly on an “if-you-ask-for-it” basis. For example, new faculty or staff are only hired to replace someone or the need becomes so apparent that current faculty and staff are severely impacted with human resource shortage. However, these approaches are clearly inadequate because by the time the need is noticed, faculty may need to wait a year or two for the procurement to be completed.

Similarly, request for equipment and materials seem to be quite ad hoc in that it is generally up to individual faculty members to ask for materials and equipment they need. While we recognize that faculty needs in terms of equipment and material can be flexible since it will depend on how the faculty member wants to teach his or her class, some items or personnel that need to be procured are easily identifiable and the need for procurement should be regularly reviewed. This includes faculty, administrative assistance, teaching assistance, course equipment, materials, library resources, advising resources and others.

Another aspect of procurement that should be considered is Reimbursement contracts. Often, the delay between identifying the need and procurement of the need is so great that faculty and staff are willing to spend out-of-pocket with the promise of being reimbursed. This process is often confusing and error prone. It would be helpful to have a system where faculty and staff can check the status of reimbursement requests rather than continually having to track down multiple personnel and offices to get this information. Regardless of process in place of how reimbursements are handled, effort should be done towards streamlining this process.

## 7. Scope Management

Effective scope management ensures that all requirements are being considered and to avoid scope creep where scope is being extended to a level where it becomes unrealistic to meet stakeholder expectations.

As with project management guidelines, we distinguish between product scope and project scope. Product scope describe the deliverables while project scope encompasses the work involved in producing these deliverables. Below is an example table that identifies two of the most easily identifiable scope of the project:

*Table 1: Product scope vs Project scope*

<b>Product scope</b>	<b>Project scope</b>
Initial accreditation or reaccreditation with no weaknesses or deficiencies.	<ul style="list-style-type: none"> <li>• Completion of self-study</li> <li>• Internal Evaluator workbook with no W or D</li> </ul>
Fully operational integration of program management with a project management software.	Setup of project management software and getting faculty and staff to use it.

Where traditional project management and program management differ is that project management generally involve one or two deliverables (e.g. completed software). Program management on the other hand, is ongoing and affected by many external factors, therefore, the project scope is more likely to change, be added into or removed from throughout a

single reaccreditation cycle. Therefore, it is especially important that the scope review and control become part of the regular agenda of faculty meetings.

### **C. Principle #3: Leveraging Automation Techniques and Tools**

Many engineering programs in small to medium teaching universities, especially new programs, may only have a handful of full-time faculty members dedicated to the program. Therefore, it becomes very critical to leverage as much automation techniques and tools as possible. Preferably, these tools are free or can be obtained at low cost. Fortunately, many such tools are available. The following are the type of tools that are currently being used by the program. For each type, there are typically many versions that are open source or freely available.

- Project management software
- Shared document repository
- Shared calendar
- Automated task reminders

The key areas of project management discussed previously provide a solid groundwork for establishing a project management system that can efficiently facilitate accomplishment of the two main objectives – obtain accreditation and efficiently manage a program with minimal resources.

For managing our program, we use a free application called *Jira*. Many features described in Jira below are typically available in other project management application as well. Other options are Wrike, Trello, Zoho and others.

Jira has the limitation in that there are only two levels of task hierarchy – tasks and subtasks. To navigate this, our program management system has the following main-level tasks:

- Manage Criterion [1...8]
- General Program Tasks
- Meeting Action Item tasks
- Recurring Program Tasks
- Advisory Board Management Tasks
- Self-study Preparation Tasks
- Campus Visit Preparation Tasks

In general, each Manage Criterion [X] consists of three types of tasks, namely:

- Summary or description of current state
- Assess whether needs are met
- Evaluate and make changes

The first item describes the current state of the program with respect to the criteria. Then, the current state is assessed against the identified needs of the program which are derived from the PEV worksheet items. Lastly, changes are recommended and applied to make program improvements. These three steps form a cycle, indicating that continuous improvement is not just

adopted in student work assessment against the student outcomes, but rather, in all aspects of the program.

Fig. 3 shows a chart of the JIRA tasks associated with the criterion 4: Continuous Improvement for a two-year assessment cycle (fall1, spring 1, fall 2 and spring 2 semesters).

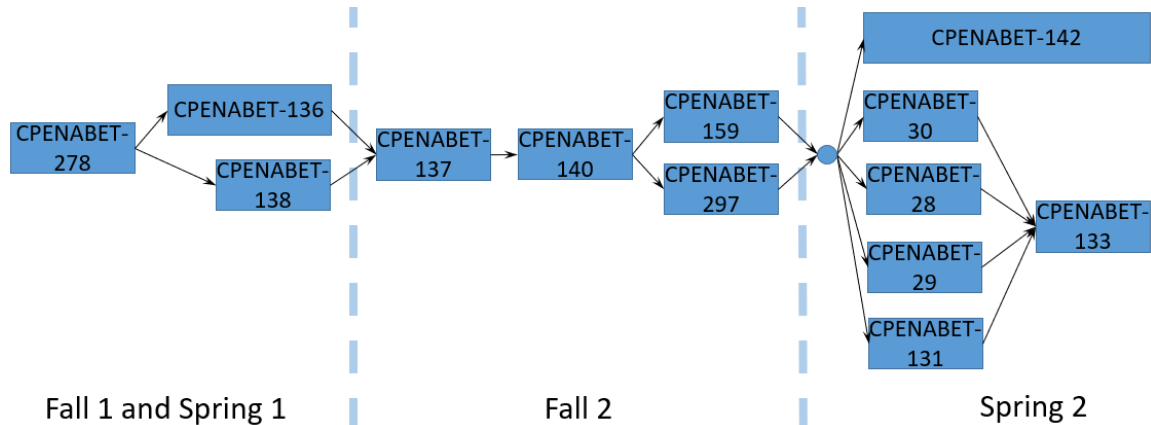


Figure 3: Task Chart for Criterion 4

The tasks with the (A) prefix are recurrent and assigned to an individual; tasks with (M) prefix are recurrent meeting action items that require quorum. This designation is important for accountability and ensures that tasks with (A) prefix are assigned to a specific staff or faculty member. The “CPENABET-X” tag is a unique identifier Jira generates for the task and is used as a unique ID of the task. These tasks are further described below:

- CPENABET-278: (A) Include Course Learning Outcomes and program Student Outcomes in the syllabus
  - A reminder to instructors to include outcomes in their respective course syllabi
  - Must be completed before the start of each semester
- CPENABET-136: (A) Complete course assessments
  - Conduct assessment and gather data and assessment artifacts during the semester
  - Must be completed before the end of the semester
- CPENABET-138: (A) Conduct graduating senior self assessment
  - Conduct an indirect assessment among graduating seniors in the form of a survey
  - Must be completed before the end of the semester
- CPENABET-137: (A) Compile assessment data for analysis and evaluation
  - Assessment data is compiled and descriptive statistics are obtained
  - Must be completed within the first two months of Fall 2
- CPENABET-140: (M) Evaluate assessment results
  - Improvements and changes are identified
  - Must be completed within the first three months of Fall 2
- CPENABET-297: (M) Review and update course learning outcomes
  - Review and make changes to the Course Learning Outcomes, if deemed necessary as a result of evaluation
  - Must be completed in the first two months of Spring 2
- CPENABET-159: (A) Submit Curriculum Revision proposal

- If changes are identified that involve curriculum changes, the proposal is written and submitted to EPC
  - Must be completed by the end of Fall 2
- CPENABET-30: (M) Review and Update Assessment threshold levels
  - Review and make changes to the assessment threshold level, if deemed necessary
  - Must be completed in the first two months of Spring 2
- CPENABET-28: (M) Review and update PIs and Rubrics
  - Review and make changes to the Performance Indicators and Rubrics, if deemed necessary
  - Must be completed in the first two months of Spring 2
- CPENABET-29: (M) Review and Update Curriculum Map
  - Review and make changes to the curriculum map, if deemed necessary
  - Must be completed in the first two months of Spring 2
- CPENABET-131: (M) Evaluate the Assessment Process
  - Review and make changes to the Assessment Process, if deemed necessary
  - Must be completed in the first two months of Spring 2
- CPENABET-142: (A) Implement program changes due to assessment and evaluation of the process
  - Facilitate the implementation of identified changes to the program
  - Infrastructure for supporting changes that do not require significant time to implement (e.g. facility upgrades) should be put in place before the next assessment cycle begins (Fall 1 of next cycle).
- CPENABET-133: (A) Update the Assessment Process and Tools Description
  - Keep the assessment process description current
  - Must be completed by the end of Fall 2

#### **D. Principle #4: Amortization and Distribution of Work**

The most significant adoption of this principle in our approach is in treating the self-study as an integral part of the process rather than a document that is only relevant when accreditation is up. The self-study is kept as a shared (with necessary security settings) location where authorized users will be able to access it and make updates by the due date. The self-study is stored in a form that version control is easily implemented (even Google Documents is able to do this). The incremental, ongoing and frequent updates to the self-study allows work to be divided up and amortized through several years. This means that when accreditation or reaccreditation year comes up, there is no need to hire a dedicated ABET staff and the burden on faculty is lessened. Ideally, a self-study is ready and complete at any time. This also removes the need to track down artifacts to retroactively document updates. In this method, the self-study also serves as a documentation archive.

We have seen the distribution of work in the form of task assignments. The program management software provides accountability and transparency in terms of task assignments and distribution of responsibilities. Additionally, it provides sustainability because the individual tasks are designed to be very instructive in terms of what needs to be done. For example, Fig. 4 shows the description of the task “Evaluate assessment results”, which is a subtask of the “Mange Criterion 4” task. The task description contains links that take the user directly to the

parts of the self-study that needs to be accessed or updated. If there are ever changes in personnel, the process still goes on due to the detailed instructions.

The screenshot shows a task management interface for a task titled "(M) Evaluate assessment results". At the top, there are action buttons: Edit, Comment, Assign, More, Start, Done, and Admin. Below this, the task is categorized into several sections:

- Details:**
  - Type: Sub-task
  - Priority: Medium
  - Labels: Criterion4
  - Evaluator Worksheet Item: Results of evaluations systematically utilized as input for the continuous improvement of the program
  - Status: TO DO (View Workflow)
  - Resolution: Unresolved
- People:**
  - Assignee:
  - Reporter:
  - Votes:
  - Watchers:
- Description:**

Faculty evaluates assessment data and makes observations and conclusions on:

  - Evaluation of whether or not previous changes were effective
    - Observed improvements to Student Outcomes attainment as a result of previous evaluation changes by comparing previous and current assessment data and any other information available
    - For each Action Plan previously identified in the Continuous Improvement Log section of the self-study, identify whether effective or not in the "Results" section of the corresponding entry.
  - Evaluation of current assessment data to identify new program changes
    - Identify whether student performance meets target attainment levels specified as Assessment Thresholds
    - If thresholds are not met, identify new Action Plans to the program (not just curriculum) that can facilitate better attainment of student outcomes.
    - Log these changes as new action plan entries in the Continuous Improvement Log section of the self-study and indicate "Pending Reassessment" in the "Results" section of the entry.
    - If the Continuous Improvement Log in the self-study is too bloated, move older log entries into the Continuous Improvement Archive document in the shared drive.
- Dates:**
  - Created:
  - Updated:

Figure 4: Evaluate Assessment Results task description

## C. Conclusion

The tasks shown above are only for Criterion 4. In our implementation, this is done for each section of the self-study as specified by the Evaluator workbook. In this work, we presented several key practices that can streamline and make the accreditation process easier to handle for small to mid-size liberal arts colleges seeking ABET accreditation for engineering programs. Some of the key principles are: 1. Reuse existing work as much as possible. When designing our project management framework, we reused the Program Evaluator workbook to guide us in identifying the tasks. 2. Transparency. Due to the culture of autonomy in faculty members, transparency provides a layer of accountability and motivation for faculty members to complete assigned tasks. 3. Event-based. The task-oriented project management system is mainly reactionary in that members are notified of tasks that need completion. This is important since it avoids the need for personnel responsible for keeping track of what needs to be done and sending out reminders for them. In fact, the project management application will automatically send a reminder email to the task assignee. 4. Incremental updates. The shortage of human resources is mitigated by amortizing self-study work throughout time and dividing it up among multiple players. Tasks are scheduled that specifically require the assignee to update a portion of the self-study. In this configuration, it is however important to implement a version control system for the self-study document.

The work presented above is only in its beginning stages. For future work, we plan to investigate APIs that allows the implementation of features currently not supported by project management application, such as conditional tasks. Additionally, we plan to investigate the integration of the assessment process itself into the project management framework. Many institutions use applications such as tk20 and BlackBoard. These applications generally provide APIs for programmatically integrating them to external applications. It will be worthwhile to investigate how these can be integrated into our project management framework.

## References

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- [3] Project Management Institute, *Guide to the Project Management Body of Knowledge*, Project Management Institute, 6<sup>th</sup> edition, 2017
- [4] Soomro, Tariq & Ahmad, Reyaz. (2013). *Faculty Retention in Higher Education*. International Journal of Higher Education (IJHE). 2. 10.5430/ijhe.v2n2p147.
- [5] ABET. “Accreditation Criteria & Supporting Documents” 2018. Available: <https://www.abet.org/accreditation/accreditation-criteria/> [Accessed: Jan. 30, 2019]