# Closing the Loop: The Difference between Making Improvements and Continuous Improvement

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Abstract

Criteria[1] published by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology TAC of ABET are continually changing. In preparing for a TAC of ABET accreditation visit, many engineering technology faculty and administrators are hard pressed to distinguish between a list of useful improvement initiatives and a continuous improvement plan. This paper discusses how to make the process of program improvement continuous by "closing the loop." Closing the loop is institutionalizing the process of finding program improvement initiatives and repeating it continually. Various methods of assessment can be used to stimulate individuals to continually generate program improvement initiatives. Much can be accomplished if faculty members are immersed in a continuous improvement culture. The paper draws on the authors' program accreditation experience and discusses efforts to create a continuous improvement culture in the METS Department at Purdue University Calumet through annual report requirements deciding pay raises, promotion & tenure, creation of a continuous improvement advisory team, and several other continuous improvement initiatives.

## I. Introduction

Why do the administrators and faculty responsible for technology programs have a problem distinguishing between a list of program improvement initiatives and a continuous improvement plan? Part of the problem is unfamiliarity. The *Criteria for Accrediting Programs in Engineering Technology* before 1997-98 did not require that a continuous improvement plan be implemented. The TAC of ABET accreditation process has changed to increasingly emphasize the continuous improvement process. A measure of the increasing emphasis on continuous improvement is evident by looking at the *Engineering Technology Program Evaluation* questionnaire, Form T4, used by evaluation team members. For the 1992-93 accreditation cycle, the T4 had no questions on continuous improvement. The program accreditation cycle beginning in fall 1999 marked the first time TAC evaluators looked for evidence that a written continuous improvement plan had been implemented and that assessment data were being used to improve the program. Currently, there are five questions on the T4 form related to continuous improvement that evaluators must answer based on interviews and a two-volume self-study questionnaire. The lack of a continuous improvement plan and evidence of implementation leading to program improvements are weaknesses frequently cited by TAC evaluators. A

prerequisite to a functioning continuous improvement plan – clear goals and objectives, was lacking for many programs to the extent that this deficiency was the most frequent finding in the 1999-2000 program accreditation cycle according to TAC past chair David Baker[2].

A hint to faculty or administrators who are responsible for accreditation or reaccredidation is to download a copy of the T4 form from the TAC of ABET web site[3]. Being able to provide answers and supporting evidence for the questions posed in the T4 will is a prudent way to prepare for the accreditation visitor who will be filling out the T4 to evaluate the program. Seeing exactly what questions are of concern to TAC of ABET also helps to eliminate misunderstandings surrounding requirements of the *Criteria for Accrediting Programs in Engineering Technology*.

TAC of ABET is revolutionizing the accreditation process in engineering technology (ET) with the new "TC2K" criteria. Instead of only "taking a snapshot" of where a program is at one point in time, TAC of ABET wants assurance that a program will not get worse but will improve between visits. In the past, the accreditation process primarily looked at inputs to student education. The Engineering Accreditation Commission (EAC) of ABET replaced its "bean counting" approach in EC2000 with requirements that programs demonstrate that students have certain abilities. TAC is moving in a similar direction with TC2K. Both accreditation criteria require on-going assessment and continuous improvement. Engineering programs are required to assess and continuously improve outcomes, while ET programs have a broader requirement to have plans for continuous improvement and evidence that results are used to improve and develop the program. Developing successful continuous improvement plans that produce documented results takes time. A feeling of urgency should be encouraged in the ET community.

TAC has long been requiring survey data from alumni and employers, but as current TAC chair Frank Hart put it, "TAC is moving to accredit based on the effectiveness of a program's quality assurance system rather than on past performance[2]."

II. Preparation for a TAC of ABET Accreditation Visit

Before the 1999-2000 cycle, TAC evaluators did not check for program improvements beyond keeping current with surrounding industry. Now, continuous improvement must be implemented. The year before an accreditation visit, a natural tendency of engineering technology programs is for one or several individuals to drive the improvement process by compiling a list of potential improvements and then carrying out a few shortly before the accreditation visit. This approach is far from continuous. If there are personal or personnel changes, it may not even be repeatable. A list of improvements that have been made may be better than the previous minimum, but it is not enough today.

What is continuous improvement? Despite many complete books written on the topic, most faculty and administrators remain unsure. In an article in Quality Digest, Danny Langdon[4] states, "Continuous (Process) Improvement is designed to utilize the resources of the

organization to achieve a quality-driven culture. Individuals must think, act, and speak quality. An organization attempts to reach a single-minded link between quality and work execution by educating its constituents to "continuously" analyze and improve their own work, the processes, and their work group."

One way of describing continuous improvement for engineering and technology accreditation is: 1. Say what you do. 2. Do what you say. 3. Prove it. 4. Improve it. 5. Start the process again by saying what you now do after improvement and 6. Continue from step 2. In other words, "Closing the loop" is necessary. Closing the loop is institutionalizing the process of finding program improvement initiatives and repeating the process continually. Engineering programs have begun to accumulate some significant useful experience in closing the loop in continuous quality improvement[5]. Langdon's description of continuous improvement emphasizes the cultural aspect. Continuous improvement is part of what professionals do in the course of their teaching responsibilities.

At Purdue University Calumet we purposely emphasize the culture of continuous improvement by incorporating it into our normal routine.

III. Continuous Improvement in the METS Department of Purdue University Calumet

1. Annual Reports In March, each faculty member in the department of Manufacturing Engineering Technologies and Supervision (METS) constructs an annual report that is used for determining raises. This report is done in a continuous improvement format. The report starts with an individual mission statement followed by general goals/objectives in support of the mission, and then tactics and strategies to achieve the goals and objectives. Finally, at the most detailed level, the report lists the faculty member's activities, accomplishments, honors, publications, presentations, course improvements, student evaluation scores or other evidence of improvement under the appropriate goal, objective, tactic, or strategy. The reports are circulated to department members. A department faculty committee ranks contributions of the faculty, including their own, based on the reports. The department head does an independent assessment, presents the evidence, and makes recommendations for raises to the dean. The continuous improvement focus of the annual report tends to remove personal issues such as collegiality from consideration. The same general format is used in promotion and tenure documents.

2. Course Update Forms After each semester, every faculty member turns in a course update form, which is obtained from a department web page[6]. The form shows any course improvements made, such as new textbooks, rewritten syllabi that include student objectives or assessment measures, laboratory improvements, grants or other evidence of continuous improvement. If no form is turned in, it is assumed the faculty member has coasted in that course that semester. The course update forms produced by an individual are attached to his or her annual report. An example form is shown in the appendix.

The School of Technology sponsors periodic workshops on assessment. These started with a workshop on improving syllabi and linking syllabi to assessment. Other workshops are planned to consider linking course objectives and assessment outcomes with program goals and objectives. Several interested faculty have attended regional or national workshops on assessment. In turn they have shared what they learned with other faculty members.

3. Student Course Input Some faculty in the department have started doing a "continuous improvement" feedback session with their students when convenient pedagogically. Students are asked for open-ended suggestions on what they think would improve their learning, increase their interest, help them at work, help them in other classes, or otherwise make the class a more positive educational experience. Students are also asked for feedback on course content. Since TC2K requires ET programs to demonstrate that graduates have a commitment to quality, timeliness and continuous improvement, it is valuable to have faculty model the behavior and involve students in the culture of continuous improvement. One professor in the Purdue University Calumet School of Technology asks for written feedback once week. The purpose is to assess and continuously improve individual classes by asking students which topics they thought were important and which were the murkiest. Positive results have been obtained and the effort is developing into embedded assessments where faculty put assessment questions from certification practice exams into quizzes or tests.

4. Continuous Improvement Steering Team One of the first things that industry does in implementing continuous quality improvement is to put together a continuous improvement steering team to serve as an implementation advisory committee. This model has been followed at Purdue University Calumet. Within the METS department, a team was appointed to encourage the department faculty to undertake and document continuous improvement efforts and advise the administration on how to support the effort. The team consists of faculty members who teach total quality management in the industrial engineering technology program and those who are TAC program evaluators for mechanical engineering technology. The team keeps track of ongoing continuous improvement efforts with a web form[7], suggests improvement initiatives, and advises other faculty members. It meets once or twice a month. Among its responsibilities are keeping the department's missions, goals, and objectives aligned with the universities missions and goals. The team links goals to initiatives requiring resources for budget and planning purposes. It documents and records improvements and why initiatives leading to improvements were proposed. It spreads ideas from innovators to the rest of the faculty. The team is planning assessment measures now so they will be in place well before the next accreditation visit in 2005.

5. Administrative Services Continuous Improvement Program Administrative Services at Purdue University Calumet includes essentially every staff member not in an academic department, including registrar, admissions, placement, housekeeping, police, computer services, facilities, maintenance, and so on. Approximately 30 administrators in Administrative Services were trained to become self-assessors using the Baldrige Criteria[8]. Shortly thereafter, Administrative Services adopted the Baldrige Criteria as their self-assessment method. During the summer of 1997, a self-assessment committee and two self-assessment teams were formed to

conduct the self-assessment of Administrative Services. The self-assessment teams conducted interviews with employees of Administrative Services. Interviews were also conducted with customers from all levels of the University. The result of these interviews was a self-assessment report that identified areas of Administrative Services strengths and improvement needs. These improvement needs were prioritized, and six categories of improvement needs emerged as the most critical at that point in time. Six teams were formed to address each of the six categories. Currently, these teams are implementing the Baldrige criteria into daily operations. The METS Department faculty receive periodic newsletters on the program and are continually exposed to the $E^2$=Q logo (Exceeding Expectations equals Quality) on posters and banners around the university. Faculty members benefit from these efforts because the level of support for faculty has increased. Students and faculty alike are less frustrated by red tape.

6. Purdue University Excellence 21 Program Excellence 21 is a system-wide effort started in 1995 by Purdue to explore the principles of continuous improvement and total-quality management[9]. Developed with assistance from Motorola, Inc., Excellence 21 is designed to allow Purdue to use some of the tools of the business world without altering the core values or missions of the university. People and resources from the company and Motorola University trained and consulted with faculty and administrators from the West Lafayette campus. One of the results was a commitment to continuous improvement at the highest levels of the Purdue administration. We have borrowed our web based *new quality initiative proposal form* and modeled our web listing of completed quality initiatives from Excellence 21. Departments in the School of Technology at the Purdue West Lafayette Campus have provided us materials for writing good objectives for course syllabi and developing assessment measures. Articles on the development of a continuous quality improvement program in the MET program there also provided us with ideas for our program[10, 11].

## Conclusion

From the authors' experiences, many engineering technology programs are struggling with continuous improvement. A common mistake is thinking a list of improvements created on a periodic basis (before every accreditation visit) is continuous improvement. Faculty members at Purdue University Calumet are working to institutionalize the process of continually finding and implementing program improvement initiatives by creating a culture of continuous improvement. Of the several measures that have been implemented at the Purdue University Calumet and the Purdue University West Lafayette Campuses, the first and most fundamental step was to create a continuous improvement steering team that serves as an implementation advisory committee. It serves as a catalyst. The requirement by the METS department head that all faculty members turn in a course update form for each course taught, might be regarded as the most effective single motivational tool to date.

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He is a TAC accreditation team chair. He is chair of the ASME committee preparing MET program criteria for TC2K.

Appendix

## METS Department Course Update Record

**Course No.:** MET 214 **Course Title:** Machine Elements

**Catalog Description:**
The theories and methods developed in statics, dynamics, and strength of materials and applied to the selection of basic machine components. The course will develop the fundamental principles required for the selection of the individual elements of what a machine is composed. Selected course topics are included as computer programming projects.

**Prerequisites:** MET 161, MET 211, and MET 218; or consent of instructor.

**Semester Updated:** **Fall** **Year: 2000**

**Type of Update:**

| | | |
|---|---|---|
| ☐ **New Edition of Text** | ☐ **New Software** | ☐ **New Lab Equipment** |
| ☐ **New Text Adopted** | ☐ **Teaching Initiative** | ☐ **Teaching Method** |
| ☐ **Catalog change** | ☐ **Significant Lab Updates** | ☐ **Learning Assessment** |
| ☒ **Other** | | |

Added assessable objectives to the course syllabus. Revised syllabus on web. Revised material covered so more emphasis would be put on machine elements with less duplication of material covered in the strength of materials course. Added AutoCAD gear drafting project.

**Assessment Method Used to Evaluate Short Term or Long Term Results**

Assessment measures will be developed the next time the course is offered.

**Date Submitted:** 1/16/2001 by G. Neff

**Date to be Reviewed:** Next MET 214 offering.