Assessment Analysis in Criteria 2000

M. A. Thornton R. W. Skeith

Department of Computer Systems Engineering
University of Arkansas
{mat1,rws}@engr.uark.edu

ABSTRACT

ABET Criteria 2000 for engineering accreditation contains many new innovative ideas and methodologies. A principle element of the criteria is self-evaluation accomplished by the analysis of identified metrics used to assess progress toward meeting defined goals. Assessment data collection and analysis is crucial for successful self-evaluation. As faculty members of an engineering department in the first University to be evaluated under ABET Criteria 2000, we outline a continuous improvement process and provide details of the assessment data collection and analysis portion of the process.

1.0 INTRODUCTION

The ABET Engineering Criteria 2000 [1] outlines a departure from the previous accreditation criteria. In the past, engineering programs were evaluated for adherence to a set of predetermined criteria versus the new approach where engineering programs are afforded more latitude in their approach to achieving goals. However, it is incumbent upon the programs to ensure continuous improvement. This is accomplished through *assessment* and associated feedback *processes*. As in the work [2], we refer to assessment as the process of identifying, collecting and evaluating data.

In Criteria 2000, goals and customers must be identified initially. Following this definition, appropriate processes are developed to move toward achieving the goals which ultimately will provide increased product quality for customers. In order to determine if the processes are working, data is collected for the computation of metrics that are used to indicate the degree of success achieved from individual processes. Determining this "degree of success" is the act of evaluation. Incorrect conclusions may be drawn, if assessment errors result from using irrelevant metrics, computing metrics with incorrect or erroneous data, or, misinterpreting the meaning of the associated metrics.

In this paper, we describe the continuous improvement model and give an example of its implementation with one of our identified goals. We also outline some of the errors that can occur in both the process feedback (referred to as procedure modification here) and self-evaluation due to assessment errors.

2.0 NEED FOR ASSESSMENT

Assessment, the collection and evaluation of data, is not a new concept to engineering educators since this is an integral step in most research projects. However, the application of assessment to educational activities does lead to the development of new

types of data sets and interpretations that are unique to the educational process. The determination of the type of data to be collected and what that data means is crucial to the effective implementation of the processes outlined in Criteria 2000.

A fundamental characteristic of Criteria 2000 is the concept of continuous improvement which can be facilitated by a process that includes a feedback path outlined as follows:

1. Identification of objectives and goals
2. Implementation of procedures for goal achievement
3. Determination of assessment techniques
4. Feedback to allow procedure modification
5. Evaluation for measuring the degree of goal achievement

This type of process can be characterized by a general block diagram that includes feedback paths for continuous improvement as shown in Figure 2.1. In this diagram, we illustrate that assessment serves two important roles; input to procedure modification and evaluation of whether program goals and objectives have been met.

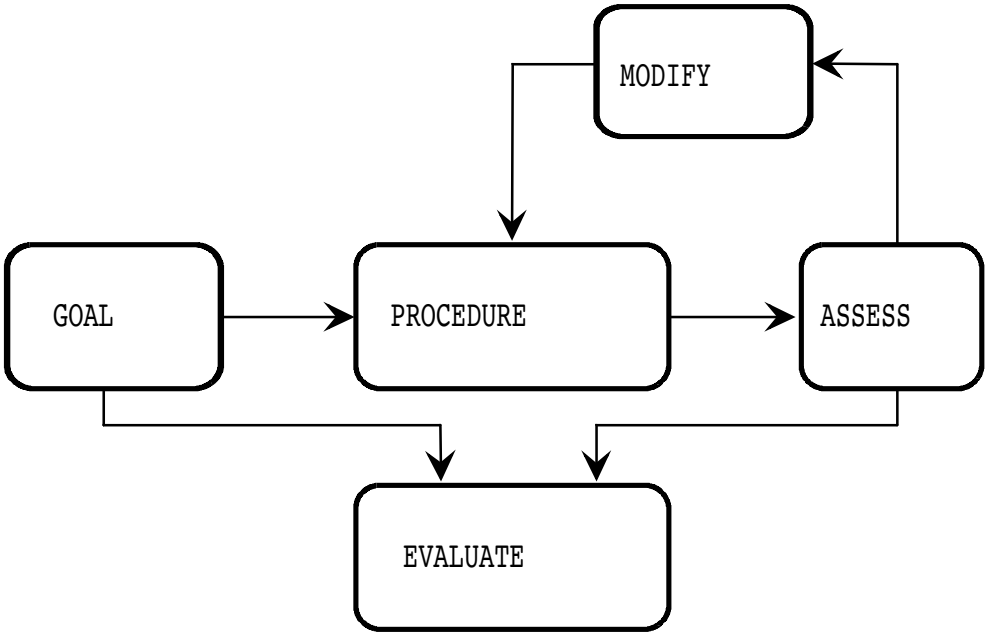

Figure 2.1: Block Diagram of Continuous Improvement Process

While the process shown in Figure 2.1 is very general and may be used to continually improve and achieve a variety of goals, the proper choice of assessment is crucial. Different types of errors may occur due to the improper choice of assessment criteria.

1. Collection of data that are irrelevant to the goals and objectives
2. Invalid interpretation of relevant data
3. Collection of a biased sample of data

Any of these assessment problems can lead to severe overall consequences in the continuous improvement process illustrated in Figure 2.1. Some of these include:

1. Determination that goals and objectives are not being met when they really are
2. Incorrect modification of procedures based on invalid assessment data or interpretation of assessment data

3.0 CONTINUOUS IMPROVEMENT EXAMPLE

An example of the continuous improvement process that the Computer Systems Engineering Department has implemented is outlined as follows:

GOAL:
The quality of graduates of the Computer Systems Engineering program is largely dependant on the abilities of students attracted to the department. The department desires to attract and retain a high quality student population.

ASSESSMENT:
1) Number of students majoring in the department
2) Number of students receiving academic scholarships
3) Number of new freshman enrolled in the department
4) Number of transfers enrolled in the department
5) ACT and GPAs of new students
6) Rising Junior Examination scores
7) Junior English examination scores
8) Senior exit interviews
9) Student Co-op program employer evaluations

PROCEDURE:
1) The department will visit college fairs in Arkansas and states contiguous to Arkansas and identify candidates for high quality Computer Systems Engineering students.
2) Prepare and mail literature to high school career counselors.
3) Make on-site visits and give presentations to high schools with high quality students (such as the Arkansas School of Math and Science).
4) Make the prospective students aware of the numerous financial aid opportunities available. Specifically, inform them to adhere to the financial aid application deadlines.
5) Encourage the students to obtain *Free Application for Federal Student Aid* (FAFSA) forms.
6) Maintain an informative WWW site that contains links to the various financial aid opportunities.

MODIFY:

1) We found an effective modification to our procedure was to offer prospective students tee-shirts with the CSEG logo as rewards for visiting departments. This is free advertisement that tends to keep the CSEG department as an option in the mind of the prospective student. This also gives the department visibility among the students' peers.
2) Increase the amount of scholarships for deserving students. New sources of scholarships are being sought through local industry that have traditionally hired CSEG graduates.
3) Updated the curriculum to include a entry-level class that aids the student in determining academic goals and methods for enhancing their success in achieving the Bachelor of Science degree in Computer Systems Engineering. This also gives entering students a "flavor" of the CSEG curriculum during a time that most engineering students are spending the majority of their effort in math and physical sciences.
4) Greatly increased the number of faculty visits to high schools and college fairs.

EVALUATE:

The evaluation requires careful analysis of the assessment outcomes. Some of the metrics that are used to evaluate this process are:

1) The ratio of students with high GPAs versus the total student population.
2) The ratio of students with high ACT versus the total student population.
3) The ratio of students with academic scholarships versus the total student population.
4) The ratio of graduates to incoming freshmen during the year the graduates entered the University of Arkansas.
5) The Rising Junior examination tests the students' math and science abilities and is given to all state supported university students. An evaluation metric is to compare the performance of CSEG students with other students throughout the entire state of Arkansas.
6) The Junior English examination is used to test the proficiency of college Juniors in written communication. Poor performance requires the student to enroll in a upper level english composition course. Rising Junior and Junior English examination average scores should increase over time to ensure continuous improvement.
7) Senior exit interviews allow the students to evaluate the education they have received including equipment, faculty classroom performance, advising. Any common areas of concern can then be determined for modifying the procedures.

3.1 ASSESSMENT PITFALLS

The assessment data outlined above could be misinterpreted with erroneous results in evaluation occurring. As an example, one of our assessment data points is the number of students majoring in the department. This value by itself could lead to errors in both procedure modification and self-evaluation. If the number is low, procedures may be modified to increase it. However, simply increasing the number of students does not meet the goal of attracting and retaining "high quality" students. On the other hand, a

large value may be incorrectly determined to indicate that the goal is being met. Large numbers do not necessarily reflect on the "quality" of the students. This data is essential however for assessment evaluation in that it is used to compute ratios of students with scholarships and other indications of superior performance to the total population.

4.0 CONCLUSIONS

The experiences of the University of Arkansas Computer Systems Engineering Department indicate that compliance with Engineering Criteria 2000 improves the quality of engineering education. We have found this criteria requires continuous effort on the part of the faculty to be effective. The continuous improvement process outlined here requires constant attention to the gathering of assessment data and its interpretation for goal evaluation and procedure modification.

In terms of report preparation for Criteria 2000, all processes should be thoroughly documented. This requires effort to be expended throughout the entire time between reviews and is not simply the collection of data prior to a ABET visit. All of the information that was previously required should also continue to be collected and evaluated to aid in the assessment process.

BIBLIOGRAPHY

[1] Engineering Criteria 2000, Engineering Accreditation Commission of The Accreditation Board for Engineering and Technology.

[2] Rogers, G. M. and Sando, J. K., Stepping Ahead: An Assessment Plan Development Guide, Rose-Hulman Institute of Technology, 1996.

[3] Babcock, R. E. and Skeith, R. W., Criteria 2000 --The New Game in Town--How Does It Play Out, 1997 AIChE Annual Meeting, 1997.

[4] 25 Snapshots of A Movement Profiles of Campuses Implementing CQI, American Association for Higher Education, 1994.

[5] TQM: Will it Work on Campus ?, American Association for Higher Education, Change, May/June 1993.

[6] CQI 101: A First Reader for Higher Education, American Association for Higher Education, 1994.

[7] Roadmap to Resources: Sources and Tools for CQI Implementation, American Association for Higher Education, 1996.

[8] Lessons Learned, The AQC Baldridge Report, Academic Quality Consortium, American Association for Higher Education, April 1995.

[9] Tucker, A., Chairing the Academic Department Leadership Among Peers,American Council on Education, Macmillan Publishing Company, New York, 1984.

AUTHOR BIOGRAPHIES

Mitch Thornton received the Ph.D. in Computer Engineering and M.S. in Computer Science from Southern Methodist University, M. S. in Electrical Engineering from University of Texas at Arlington, and B. S. in Electrical Engineering from Oklahoma State University. He has been employed as an Assistant Professor of Computer Systems Engineering since 1995. Mitch also has over 5 years of experience as a design engineer at Raytheon E-Systems and Cyrix corporation.

Ron Skeith received the Ph.D. in Engineering from Arizona State University and the M.S. and B.S. degrees in Industrial Engineering from Oklahoma State University. He has been employed at the University of Arkansas for the past 33 years. Ron became Department Head of the Computer Systems Engineering Department in 1985. Ron also served as an ABET visitor for 10 years and is experienced in hosting accreditation visits; four over the past six years.