Evolution of Assessment Within a Mechanical Engineering Technology Department

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Abstract

With a successful ABET accreditation recently behind us and a regional accreditation almost upon us; the Mechanical Engineering Technology Department of the School of Technology at Purdue University has experienced maturation of its assessment and continuous improvement activities. Namely, with our short history of what works versus what does not and with valuable input from other School of Technology departments, a shift appears to have taken place where focus and responsibility are concerned. Eight departments, which make up the School of Technology, have completed audits of department assessment processes. Feedback from these audits has provided encouragement for focusing on how individual courses support achieving the goals and objectives of our department, school, and university. While assessing student learning remains a key activity, it is no longer the sole focus it once was. Our department has also seen a shift from continuous improvement and assessment direction emanating from a single point, i.e. Continuous Improvement Committee, to becoming the responsibility of every departmental committee and faculty member.

While our initial efforts have been discussed in similar settings before, we have since identified areas of growth in our philosophy towards assessment and improvement; areas that may be of interest to other Engineering Technology programs as they continue to expand their assessment and improvement activities. This paper will discuss the evolution of assessment philosophy and techniques within the Mechanical Engineering Technology Department and significant changes in how our department accomplishes assessment. Experiences of what activities have been beneficial to our efforts and which activities have not will be shared. This paper’s approach will be a points-to-ponder one rather than a how-to list. Additionally, consideration will be given to areas Engineering Technology programs might reflect on as they prepare in the future for both TAC-ABET and Regional accreditation reviews. That is, can one method of documentation efficiently satisfy both parties?

I. Initial Assessment Activities

A brief description of activities Mechanical Engineering Technology was involved in 1998 follows. More detailed information is provided in a previous paper that this author co-authored.1

Continuous Improvement Committee (CIC). This committee was the starting point for most activities undertaken by the Mechanical Engineering Technology faculty. CIC responsibilities included recording and maintaining documentation efforts for visiting assessment teams,
monitoring accreditation requirements, and dissemination of information related to continuous improvement and assessment to all department faculty members. This committee existed within the Mechanical Engineering Technology department from May 1994 through August 1999 and active committee membership consisted of Mechanical Engineering Technology faculty.

**University Wide North Central Assessment Effort.** For over five years now, the Mechanical Engineering Technology department has had a representative on a School of Technology Assessment Committee. The School of Technology Assessment Committee is made of representatives from each of the school’s eight departments and is facilitated by a school administrator who also serves as the school’s representative to a university level North Central Assessment Committee. In the past the school committee has served as a forum for sharing ideas and suggestion between departments. The school committee also sponsored an information session on assessment methods which was open to all school faculty. Finally, the committee developed a model for all departments within the school to use as a standard for developing their own assessment system.

**Strategic planning.** In order to allow faculty members to focus on planning and improving the operation of the Mechanical Engineering Technology department, a two-day retreat took place in Fall 1995. During the retreat, faculty members developed a list of concerns and recommended actions in seven key areas:

1. Student recruitment
2. Assessment - how students learn
3. Modernizing equipment, facilities, and instructional technology
4. Distance learning and Purdue Statewide Technology (PST) development
5. Faculty professional development
6. Assessing teaching performance
7. At-risk students/remediation

Another strategic planning retreat followed in Spring 1999 which included a status report of the department’s previous strategic plan (Fall 1995). New concerns were identified along with recommended actions in the following key areas:

1. Undergraduate programs
2. MET enrollment and MET’s professional appearance
3. Laboratories and equipment
4. Faculty opportunities for continued professional growth
5. MET graduates in the SOT Graduate Program
6. Efficiency of MET Department operations
7. MET’s use of classroom technology
8. Statewide Technology issues
9. Alumni and industry relations
10. Integrate continuous improvement process into all areas of MET Department.

**Establishing a time line for continuous improvement initiatives.** From Fall 1995 through Fall 1998, the continuous improvement committee maintained a planning calendar of the Mechanical
Learning objectives project. All Mechanical Engineering Technology faculty participated in developing course learning objectives for each Mechanical Engineering Technology course. Objectives developed during this project improved upon earlier versions of course objectives because they were written to be measurable and thus used for assessing student learning. Mechanical Engineering Technology faculty were encouraged to track student performance against the new learning objectives and identify improvement projects for student learning based on the measurements collected.

Graduate exit survey. A graduate exit survey was issued at the end of each Spring semester beginning in 1996. The survey directs students to rate and comment on faculty, staff, course, equipment and facility effectiveness and/or success. Students are also asked to comment on the value of their education, co-op employment experience, and the strengths and weaknesses of the Mechanical Engineering Technology department. Results were shared on a confidential basis with each faculty member during fall planning meetings with the Mechanical Engineering Technology department head.

Individual faculty teaching improvements. Individual improvements were encouraged. At several 1998 and 1999 faculty meetings, faculty members shared their continuous improvement experiences with other Mechanical Engineering Technology faculty to help individuals identify assessment methods that work for their course material and teaching environment.

II. Current assessment activities

A brief description of current Mechanical Engineering Technology activities follows. Figure 1 can be used to better visualize ways in which the Mechanical Engineering Technology department’s assessment focus has changed.

Mechanical Engineering Technology Administrative Council. This committee was created by the Mechanical Engineering Technology acting department head in Fall 1998 and is made up of department committee chairs as well as other key department representatives including the department’s Continuous Improvement Coordinator. The committee charges are numerous but include providing leadership on integrating the continuous improvement process into all areas of the Mechanical Engineering Technology Department.

University Wide North Central Assessment Effort. A North Central Accreditation visit was completed in November 1999. Since the focus of the university committee was to prepare the university for the accreditation visit, the committee’s future is uncertain. On the other hand, the School of Technology Assessment Committee has its own momentum and while preparing the school to meet the assessment criteria of North Central Accreditation was a committee charge, the committee has also developed a focus on meeting goals, making improvements and maintaining a forum where school departments can share experiences. It is quite likely the
School of Technology Assessment Committee will continue to function in a supportive role for the near future.

Figure 1. Comparison of past and current assessment focus in Mechanical Engineering Technology.

<table>
<thead>
<tr>
<th>Area</th>
<th>1998 and Prior</th>
<th>1999 and Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation</td>
<td>Up to MET</td>
<td>Internal Audit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Input From Other Departments</td>
</tr>
<tr>
<td>Responsibility</td>
<td>Continuous Improvement Committee MET Faculty</td>
<td>Department Head</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MET Committee Chairs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MET Faculty</td>
</tr>
<tr>
<td>Source of ideas, methods</td>
<td>Continuous Improvement Committee</td>
<td>MET Faculty</td>
</tr>
<tr>
<td>Areas of improvement</td>
<td>Student Learning</td>
<td>MET Strategic Plan</td>
</tr>
<tr>
<td></td>
<td>Recommendations from industry</td>
<td>Assessment System</td>
</tr>
<tr>
<td></td>
<td>Student surveys</td>
<td>Student Learning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recommendations from industry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Student surveys</td>
</tr>
</tbody>
</table>

Strategic planning. Building a strategic plan for Mechanical Engineering Technology based entirely on faculty input has had two major benefits. First, it has broadened communication and built consensus between faculty and administration in terms of identifying issues to improve the Mechanical Engineering Technology department and prepare it to meet future challenges. Secondly, it appears to have increased and focused faculty support towards department goals. Another strategic planning session is scheduled for Fall 2000.

Establishing a time line for continuous improvement initiatives. The time line was discontinued “as such” however time constraints and goals have been included within the Mechanical Engineering Technology strategic plan and all plan action items have been transposed into committee and individual charges. Success at meeting these goals will be reviewed with the faculty periodically.

Learning objectives project. Mechanical Engineering Technology faculty are continuing to track student performance against the new learning objectives and identify improvement projects for student learning based on the measurements collected. The Mechanical Engineering Technology Department Head currently requires a summary of improvement activities from each faculty on a yearly basis.

Graduate exit survey. The graduate exit survey continues to be issued once a year.

Individual faculty teaching improvements. Individual improvements are still encouraged. Improvement documentation consisting of written summaries of individual or team improvement efforts has been collected by the Mechanical Engineering Technology Department.
Head and is available for outside evaluators to review. An example of one of the author’s activity reports is included as Appendix A. Individuals have the option of using standard activity reporting forms or they may develop their own documentation method. Forms are available electronically or as hard copies.

_**Internal audits.**_ One outcome of the School of Technology Assessment Committee charges has been to arrange two (over a one year period) internal audits of each department’s assessment system. Assessment representatives from each department were randomly selected to visit and audit another department’s assessment system. After the audit, a short written report was drafted that highlighted positive aspects of the system and identified any areas of the system that need improvement. Most departments have found the internal audits to be beneficial. The assessment system model developed by the committee was used as a standard for comparison. It recommends each department provide documentation of the following items or activities:

- Brief description of department and its programs
- Departmental Mission Statement
- Learning outcomes for degree and program option(s)
- Current curriculums and plans of study
- Documentation of methods and techniques used to assess degree learning outcomes
- Course descriptions and learning outcomes for courses
- Documentation of methods and techniques used to assess course learning outcomes
- Summary of overall efforts and results

Each department presented their material in a three-ring binder.

### III. Discussion of key areas of change

The Continuous Improvement Committee disbanded in Fall 1999. The committee’s responsibilities have been placed, more or less, on the individual department committees as well as all faculty members. A Continuous Improvement Coordinator serves as liaison between the department and other organizations. Most industries have realized every employee of a business can impact quality and is therefore responsible for it. Similarly, Mechanical Engineering Technology has begun the evolution from “tell us what to do” to “this is what we want to be.”

The focus on assessing student learning and tracking performance on course learning objectives is beginning to expand to include evaluating how learning objectives align with and support the goals of Mechanical Engineering Technology. Besides being used for _improvement_ of a program, assessment is used for _accountability_. As is so often heard from consultants assisting businesses in preparing for a major certification process such as ISO 9001 or QS 9000, “Say what you do and do what you say!” Assessment is one way to show an evaluator that you are doing what you say you are doing. In an academic system, the institution has a mission and goals. Schools within that institution have their own mission and goals that should be aligned with those of the institution. Likewise, departments within schools should have a mission and goals aligned with those of their school. And, carrying the progression one more step, courses
and programs within a department should all serve to meeting the mission and goals of their department.

A plan for the immediate future focuses on developing an assessment/improvement plan that is simple and useful. A key element will include eliminating unnecessary production of written material and paperwork.

IV. Meeting the assessment and improvement requirements of TAC ABET and regional accreditation

Having an assessment/improvement system in place that continually monitors and improves a program has a direct benefit to that program. However, engineering technology programs are realizing that assessment and improvement efforts are required to meet accreditation criteria. Indeed, engineering technology programs may have to meet two sets of criteria: institutional and specialized. Accreditation from a regional body such as North Central Association or New England Association of Colleges and Schools is an example of institutional accreditation while TAC ABET is a specialized accreditation. A question not to be overlooked is “Can one assessment or improvement system fulfill the requirements of multiple accreditations”?

A logical place to begin is with a comparison of some common accreditation programs.

<table>
<thead>
<tr>
<th>Program</th>
<th>Geographical Area</th>
<th>(Date) Accreditation Criteria Related to Assessment and/or Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current TAC ABET²</td>
<td>U.S.</td>
<td>(1998) Within General Criteria, “Programs must demonstrate achievements through various methods, e.g., student outcome assessments, …”, also “Programs must have plans for continuous improvement.”</td>
</tr>
<tr>
<td>Proposed TAC ABET³</td>
<td>U.S.</td>
<td>(1999) Within Criterion 6, “Programs are required to have plans for continuous improvement and evidence that the results are applied to further development and improvement of the program. Each program is required to demonstrate achievements through various methods including student outcomes assessment and employer feedback.”</td>
</tr>
<tr>
<td>Program</td>
<td>Geographical Area</td>
<td>(Date) Accreditation Criteria Related to Assessment and/or Improvement</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>North Central Association of Colleges and Schools (NCA)⁴</td>
<td>AZ, AR, CO, IL, IN, IA, KS, MI, MN, MO, NE, NM, ND, OH, OK, SD, WV, WI, WY</td>
<td>(1999) Within Criterion 3 (The institution is accomplishing its educational and other purposes), “assessment of appropriate student academic achievement in all its programs” Within Criterion 4 (The institution can continue to accomplish its purposes and strengthen its educational effectiveness) “structured assessment processes that are continuous, that involve a variety of institutional constituencies, and that provide meaningful and useful information to the planning processes as well as to students, faculty, and administration”.</td>
</tr>
<tr>
<td>New England Association of Schools and Colleges (NEASC)⁵</td>
<td>CT, ME, MA, NH, RI, VT</td>
<td>From the Commission on Institutions of Higher Education (CIHE), “Accreditation is voluntary, non-governmental, and self-regulatory. It serves the dual purposes of quality assurance and quality improvement.”</td>
</tr>
<tr>
<td>Middle States Association of Colleges and Schools (MSA)⁶</td>
<td>DE, DC, MD, NJ, NY, PA, Puerto Rico, US Virgin Islands, Panama</td>
<td>(1994) Within Standards for Accreditation, “policies and procedures, qualitative and quantitative, as appropriate, which lead to the effective assessment if institutional, program, and student learning outcomes”</td>
</tr>
<tr>
<td>Western Association of Schools and Colleges (WASC)⁷</td>
<td>CA, HI, Guam and others</td>
<td>WASC is currently revising its Standards of Accreditation for implementation in 2001. Comments of interest, “…the Commission [WASC] has responded to the recommendations of the 1995 Task Force on the Role of Accreditation in the Assessment of Student Learning and Teaching Effectiveness (Task Force II) which called for increased attention to assessment of the effectiveness of the educational programs of institutions, and to demonstrated student learning.” Also “There is a continuing and perhaps increasing federal mandate for accreditation to address student achievement and institutional assessment of student learning.”</td>
</tr>
</tbody>
</table>

The table above lists the programs and their geographical areas along with the criteria related to assessment and improvement.
<table>
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<th>Program</th>
<th>Geographical Area</th>
<th>(Date) Accreditation Criteria Related to Assessment and/or Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northwest Association of Schools and Colleges</td>
<td>AK, ID, MT, NV, OR, UT, WA</td>
<td>Accreditation criteria not reviewed by author</td>
</tr>
<tr>
<td>Southern Association of Colleges and Schools</td>
<td>AL, FL, GA, KY, LA, MS, NC, SC, TN, TX, VA</td>
<td>Accreditation criteria not reviewed by author</td>
</tr>
</tbody>
</table>

For the most part, a review of the preceding table indicates that institutional (regional) accreditations have identified assessment somewhere within their accreditation criteria. TAC ABET accreditation has requirements for both assessment and a continuous improvement plan. Notice also that TAC ABET’s proposed criteria expands on assessment and continuous improvement by also requiring evidence that assessment results are used to further develop the program (the “all important” feedback loop).

It might be reasonable to propose that if a program meets the assessment and improvement criteria of TAC ABET accreditation, then, on the program level, the assessment requirements for regional accreditation will also be met. Indeed, this Mechanical Engineering Technology department’s recent experience with TAC ABET and NCA accreditation visits support this proposal.

V. Conclusion

Mechanical Engineering Technology at Purdue University may have started assessment and improvement efforts with an eye on meeting upcoming accreditation requirements however, these efforts are now viewed in terms of long-term benefits to the department. Department as well as School assessment has been carefully critiqued to make certain day-to-day activities are in cadence with department, school, and institutional goals. Resting sole responsibility of improvement and assessment development is no longer effective although it was at one time. Over time and with encouragement, individual faculty members are accepting organized assessment and improvement into their culture.

As engineering technology programs develop assessment systems and continuous improvement plans they should keep in mind both institutional and specialized accreditation requirements. It is likely a program meeting TAC ABET criteria will already be fulfilling the more general criteria for institutional accreditation as well.

Bibliography


CHRISTINE L. CORUM
Christine L. Corum is an Assistant Professor of Mechanical Engineering Technology at Purdue University, where she teaches courses related to materials and manufacturing quality control. She received a B.S. in Metallurgical Engineering from the University of Missouri-Rolla and an M.S. in Industrial Engineering from Purdue University. She is a member of ASQ, ASM, ASEE, and SWE.
Activity Summary:  Course content and delivery

Name: Christine Corum  Report Date:  8-17-98

☐ Check here if information is confidential and not to be released within the MET department.
☐ Check here if information should be shared with MET faculty.

Provide a “project title” by briefly describing the activity you are undertaking.
Polymer process labs for MET 142

Approximate time frame for activity:  Fall 1998

Activity:  (Describe the need for improvement, what information/data will be tracked or collected for measurement, who will be involved, responsibilities.)

Historically, students have displayed clearer understanding of welding and casting topics (seen on exam responses) compared to other course topics.  I believe this is because welding and casting activities are reinforced through lab exercises.  Polymer manufacturing processes are not currently covered in MET 142 lab.  Two labs will be developed that will allow students to view and/or perform from six to ten common polymer manufacturing processes.  Once the labs have been performed, student understanding will be evaluated through quizzes and exams and performance will be compared to previous performance of students that did not participate in the new labs.

Results:  (Describe the outcome of your activity in words or with numeric data as appropriate.)

Results should be available around the 10th week of the Fall 1998 semester.

Follow-up Actions:  (List actions taken or recommended based on results.)

If students demonstrate better understanding of polymer mfg. processes, then the polymer labs should become a permanent part of MET 142 lab.