The Assessment Cookbook: Recipes for Successfully Meeting TC2K Criteria

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Abstract

The authors draw on their experience and training as TAC evaluators in sharing how they are preparing their programs for TC2K. This paper will point out sources of information on how to prepare for an accreditation visit and will discuss the recipe being used at Purdue University Calumet (PUC) to meet the TC2K criteria. Thus far, a continuous improvement culture has been cultivated with several measures that will be discussed in the paper. Ten new tools for assessment are being developed that fit within a continuous improvement paradigm. Course embedded assessment measures for student outcomes data are being formalized. Why rush? In fall of 2003 TC2K will be optional, but in fall of 2004, all programs will be evaluated under the new criteria.

Old Practices versus New

Past ABET accreditation was contingent upon successful completion of a questionnaire by an institution and their collection of exhibits that showed that students did relevant assignments to which educators had provided appropriate feedback. This information would be collected for approximately one year then reviewed by a visiting team of qualified evaluators who determined if the institution was adequately instructing individuals on skills and knowledge pertinent to their chosen profession. This method of evaluating an institutional program was based on a strict list of requirements (or one might call it a "proven recipe") that was believed to produce a professional ready to contribute to the work force. Unfortunately, this method of evaluating adherence to requirements had at least one major flaw. The evaluation schedule only required a review once every six years. Therefore, the evaluation was only truly based on a snapshot in time. The requirements adhered to during the years in-between visits were never looked at. However unintentional, it would be possible for institutions to be accredited without regularly meeting the minimum requirements that professions set as the standard for educational adequacy.

The new method of accreditation, TC2K, addresses this issue by requiring an institution to provide proof of continual ongoing assessment and improvement of their programs throughout the six-year period between evaluations. In other words, TC2K requires that institutions not only collect data for show (as was the focus of the old method) but also use this pertinent data to stay current, satisfy their constituents, and continuously make themselves better. One of the positive changes of TC2K is recognition that collecting exhibits of student work does not contribute to program improvement.

Sources that will aid in Successful Assessment

Unfortunately, the new TC2K criteria can be seen as confusing to faculty and administrators who were used to being given a checklist to use as their guide to collecting the data for the program evaluators. TC2K can appear as a "secret recipe" in this fashion as the general criteria is left fairly open. As specified in the old criteria, the information to be evaluated was described in detail in ten pages. The same data in TC2K is described in just over three pages. The details are now left to the institution to determine what is relevant, appropriate and satisfying to their constituents.

However, if an institution does not feel comfortable with their identification of the appropriate information they need to generate by simply reviewing the TC2K criteria, there are less obvious alternatives where they can look for additional information. The first source is one of the most useful. You can download a copy of the Program Evaluation Form also known as the T4[1] from the TAC/ABET web site at http://www.abet.org/tac_forms.html. The T4 is the questionnaire that your program accreditation evaluator will be filling out based on the written material you have prepared or provided and from talking to faculty and administrators. If you can provide answers and supporting evidence for the questions posed in the T4, you have a tool as useful as a laser beam in cutting through the darkness of misunderstanding surrounding requirements of the *Criteria for Accrediting Programs in Engineering* Technology[2]. Use the T4 in preparing for the accreditation visit and you will be ready for the accreditation evaluator who will be using the T4 to evaluate your program. At this writing, the T4 or equivalent for TC2K was being polished and was not yet available to everyone on the web. We can however look at the "EC2000 Program Evaluator Report" to see what the committee or taskforce writing it is likely to prepare. The EAC form may be accessed on the *EAC Information for Program Evaluators* web page[3]. Comparing the EC2000 Program Evaluator Report and the TAC T4 for the old criteria, one thing stands out. To get accredited you filled out a questionnaire and "collected" information under the old criteria. It won't be enough to fill out questionnaires and passively collect graded papers and surveys under TC2K.

Training sessions will be available for TC2K program evaluators and interested faculty and administrators. ABET is partnering with the National Science Foundation, and key industries nationwide who are underwriting the costs of the faculty Technology Education Initiative regional workshops. Typically two faculty members per institution are invited to these. Larger venues will have separate workshops for training evaluators and the general ET community. The ASEE CIEC meeting in February of 2002 scheduled an evaluator training session that was open to others for the purpose of observing and learning about the change in philosophy and process for evaluators conducting TC2K accreditation visits. At the *2002 American Society for Engineering Education Annual Conference & Exposition*, an evaluator training session was scheduled along with a "Lessons Learned Panel Discussion" session describing the two 2001 pilot visits. Individual professional societies such as the American Society of Mechanical Engineers will also begin training for the ET community in 2002.

Several other assessment conferences are available to faculty and administrators. For example, Rose-Hulman Institute of Technology has a large high quality conference on *Best Assessment Processes*[4] every year. This conference is very useful and recommended for TC2K preparation.

Many other assessment and accreditation references are also available from the ASEE website[5]

The Recipe for Success at Purdue University Calumet

After reviewing various sources, becoming educated on assessment methods, and working to understand the purpose of implementing the new ABET criteria, the Department of Manufacturing Engineering Technologies & Supervision (METS) faculty at Purdue University Calumet developed a "recipe" that its program constituents would be able to use for meeting the new accreditation requirements. These requirements, as stated above, are no longer contingent upon completing a "check-list" that may or may not prove that students have learned the intended content of the program. The requirements are now based on the outcomes of the program, which would constitute a successful graduate. Therefore, the onus is on the institution to prove that what has been taught during the student's education actually results in a graduate who provides the intended knowledge, skills and abilities to an employer. This is what is considered "student outcomes assessment." This assessment is prescribed as a requirement of the new TC2K criteria.

During an accreditation visit, the evaluators will be reviewing several other items in addition to student outcomes assessment. They will review the general overall program curriculum for compliance to the basic requirements such as communications, science, and mathematics. This will be considered along with technical content and specific program criteria that have been developed by the professional society responsible for the respective educational requirements of the profession. In addition, the faculty, the facilities, and the general institution will be examined for adequacy in adherence to basic requirements prescribed in TC2K.

With these additional items and outcomes assessment in mind, the faculty at Purdue University Calumet developed their own recipe to document this information. By using this recipe, the information needed for accreditation will be continually collected, evaluated, and acted upon so that the program will stay current and be value adding in the eyes of its constituents.

The recipe consist of ten tools:
Tool1 - Summary of annual faculty data
Tool2 - Enrollment Summary
Tool3 - Equipment/Tool/Machine/Space/Technology Survey
Tool4 - Summary of Department Curriculum Documents
Tool5 - Individual Course Embedded assessment Matrices
Tool6 - Employer Survey
Tool7 - Graduate Survey
Tool8 - a through k matrix
Tool9 - SME CMfgT Exam
Tool10- Advisory Board Input

It should be noted that all of these tools do not carry the same weight within the recipe. The majority of the tools would be considered as only needing a teaspoon in this recipe, whereas Tool5-8 may be considered as needing several pounds. Tool5-8 are the course assessment tools, program educational objectives assessment tools, and student outcomes assessment tools. Tools1-4 and 9-10 look at the additional items that will be required for accreditation.

Each of these tools will be an on-going collection of relevant data that is evaluated, assessed and used where and when needed to improve the programs. The faculty has gone through the exercise of first determining what constitutes relevant data and what the data will be used for. This is to help combat the common occurrence of continually collecting data without intended use. Once the relevant data is available, tabulated, evaluated and assessed, a summary will be written to document the significant trends and implications identified. Finally, changes and improvements can be made based on the assessment of the data and the results will be documented. Each of the ten tools has been detailed as to what information is needed, where it can be collected, who should be collecting it, how often it should be collected, etc. A sample detail of Tool2 is shown in Figure 1. Other tools are shown in the appendix, although most of the critical tools are still being developed for our programs.

Assessment Tool # 2
Enrollment Summary

Data
What data is needed

1) # of students enrolled in a program per semester
2) # of credit hours taken by those same students
3) # of students with full-time status (over 12 credit hours)
4) # of courses offered per program (also # combined with other departments if any)
5) # of courses required to be canceled and reason for cancellation
6) # of graduating seniors (or A.S. and certificates graduates if this is the terminal degree for the student)
7) # of students pursuing certificates only

Where data comes from

1) Banner report based on major codes give # of students officially enrolled per semester for items 1-3 and 6 above
2) Banner report of course lists for a semester will state item 4 above
3) Program coordinators conducting graduation audits have the data on item 5 above

When data should be gathered and by whom

1) Items 1-3 and 6 above may be gathered as early as the end of late registration but should be collected and reported for maximum benefit before the next semester schedule is developed. This should be done by the program coordinator scheduling courses and should be reviewed as input to the next schedule.

Purpose for collecting this data

Development of semester schedules
Development of 3-year plan

Correlation to program and department goals

Department goals 5 and 6 are supported

Evaluation and Assessment of Data

An analysis of the raw data collected in section I will be completed and tabulated as appropriate tables, graphs, or charts. In addition, a short summary describing any significant trends or implications will be written. It is expected that the IET, OLS, MET and CGT programs will each track this data separately but in similar format so that it may also be compiled and summarized at a department level.

Outcomes / changes / improvements

When determining the data to be collected, the purpose for collecting it is to be identified. A short summary is to be written describing the outcome results, and especially improvements, from collecting and assessing this data.

Figure 1

Another added benefit to the METS department for using this recipe is that ABET is not the only group that requires a review of its assessment information. By developing the tools separately,

the particular data which any agency needs can be easily gathered and presented to the agency in question. There are three major groups which the METS department at PUC reports their assessment data to; the university itself, NCA[6], and ABET.

Continuous Improvement

Continuous improvement is an essential ingredient in meeting TC2K. We think of continuous improvement as 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. Several regular documents are required from our department faculty members that help to foster a continuous improvement culture[7].

1. Annual Reports In March, each faculty member in the department constructs an annual report, which is used for determining raises. This report is done in a continuous improvement format, which consists of an individual mission statement. Next comes overall direction followed by general goals/objectives in support, then tactics/strategy. 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. A department faculty committee ranks contributions of the faculty including themselves based on the reports. The department head does an independent assessment. He 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[8] After each semester, every faculty member turns in a course update form that is obtained from a department web page. This shows any course improvements made such as new text books, rewritten syllabi with student objectives or assessment measures, laboratory improvements or advances, 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.

3. Course Model At the beginning of the semester each faculty member prepares a course model for at least one of their courses that shows program educational objectives, student learning objectives in support, assessment measures to evaluate student outcomes and analysis/further actions. These are also attached to his or her annual report.

Conclusion

TC2K will require finding a recipe that works for your program. TC2K will drive curriculum change for our programs until we can prove that student outcomes are met for the a through k component of Criterion 1 of TC2K. As a department with four 2+2 technology programs, we have the staff and resources to devote to the effort. The more detailed list of student outcomes in TC2K might appear tougher to satisfy than that for four-year engineering programs in EC2000.

The biggest hurdle to overcome will be demonstrating satisfaction of the same a through k student outcomes requirements for our AS programs as we do with the four-year programs.

Community colleges also have only two years of course work available to satisfy student outcome criteria that engineering programs have four years worth of course work to satisfy. Obviously the a through k criteria can not be satisfied to the same extent in a two year program as they would be in a four year program. But it is also true that community colleges usually have less administrative and faculty resources to devote to preparing for an accreditation visit. It will be up to the engineering technology community and the TAC commission to help community college programs transition to the new criteria.

References

1. The T4 is at http://www.abet.org/documents/tac/T04(4-00).doc.
2. TAC/ABET Accreditation criteria is at http://www.abet.org/images/Criteria/2002-03TACCriteria.pdf
3. The EC2000 Program Evaluator Report is at http://www.abet.org/documents/eac/Evaluator_Program_Report_6-21-01.doc.
4. "Best Assessment Processes V" Symposium -- Engineering, Engineering Technology, Computing Science and Engineering-Related Programs," April 25-26. 2003, Rose-Hulman Institute of Technology, 5500 Wabash Avenue, Terre Haute, IN 47803. Link at http://www.rose-hulman.edu/users/groups/Assessment/Public/html/IRA/IRA/whatsnew/Announcement.PDF.
5. "ASEE Annual Conferences & Assessment - Historical Information Web Page" at http://www.asee.org/conferences/search/
6. Corum, Christine L, "Evolution of Assessment within a Mechanical Engineering Technology Department," *ASEE Annual Conference and Exposition Proceedings*, St. Louis, Mo., June 18-21, 2000, Session 2548. The North Central Association of Schools and Colleges (NCA) is one of the six regional bodies described in this paper.
7. Neff, G., S. Scachitti, and M. Zahraee, "Closing the Loop: The Difference between Making Improvements and Continuous Improvement", *2001 ASEE Annual Conference Proceedings*, Albuquerque, New Mexico, June 24-27, 2001, Session 2647.
8. The "Course Update Form" is at http://www.calumet.purdue.edu/public/mets/contimpr/updateform.html.

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Appendix

Assessment Tool # 1

Summary of Faculty Data

Data

What data are needed?

1) Current rank
2) Licensure/Certification
3) Educational Background
4) Historical teaching assignments – last 3 years
5) Scholarly activities – last 3 years
6) Dept./School/University Service – last 3 years
7) Current organizational memberships

Where data comes from

1) Academic Program Review Committee (Faculty Data Form)
2) Vice Chancellor for Academic Affairs
3) METS Department (Profile of Professional Activities and Growth)

When should be data gathered and by whom?

1) Every six years – currently
2) Vice Chancellor for Academic Affairs
3) (Profile of Professional Activities and Growth) Annually
4) (Part of annual review process – Departmental Secretary)

Purpose of collecting this data

1) Maintain current information on faculty competencies
2) Developmental plans for non-tenured faculty
3) Meeting established or proposed criteria for established faculty standards (i.e. ABET).
4) Annual performance review
5) Tenure and promotion tracking

Evaluation and Assessment of data

Information from the Summary of faculty data will be compiled in an appropriate table for analysis. The data will need to be separated by program area, as criteria for faculty standards are likely to be different for the accreditation of those programs.

Outcomes /changes/improvements

The Department Head and Program Coordinators will review and summarize the overall faculty competencies in terms of meeting goals. These individuals will also be able to provide coaching to those individual faculty members identified as deficient toward promotion and/or tenure goals.

Assessment Tool # 3

Equipment/Tool/Machine/Space/Technology Survey

Data
What data are needed?

1) Building space utilization – METS
2) Physical equipment (valued >$300)
3) Computer software

Where data comes from

1) University inventory
2) Department physical inventory
3) Faculty

When should be data gathered and by whom?

#1 is collected annually by University staff or faculty
#2 is collected annually by Department faculty and staff
#3 is provided annually by faculty

Purpose of collecting this data

1) Inventory control and space allocation
2) Reconciliation against physical findings
3) Justification for new and/or additional equipment or lab space
4) Generation of "wish list"

Evaluation and Assessment of data

Data collected is section I will be used in conjunction with Tools 6, 8 and 10 when evaluating goal attainment for accreditation (not OLS as of now). Data gathered will be used to help justify new and/or updated equipment and software. In addition, based on Tool 2, will also add to justification for additional lab and office space.

Outcomes /changes/improvements

The Department Head and Program Coordinators will be better able to track current equipment and software to be compared against technology goals established by the School, Department and Programs. The projections used in the 3 and 5 year plans will be more credible and focused on goal attainment.

Assessment Tool # 4
Curriculum Documents

Data

What data is needed

1) Listing of curriculum improvements
2) Reason for change/ source for initiative.

Where data comes from

1) Curriculum committee minutes
2) Relevant curriculum documents

When data should be gathered and by whom

1) Data should be gathered by the department curriculum committee chair.
2) May and December of each year
3) Requires typing report

Purpose of collecting this data

To prove that improvements were made resulting from the continuous improvement plan.

Correlation to program and department goals

1) Demonstration data for ET2K Criteria 2 and 6
2) Program Educational Objectives: Not yet available
3) Demonstration data for Department Goal 2

Evaluation and Assessment of data

Impacts and reasons for curriculum changes from department curriculum documents, minutes of the school of technology curriculum committee, minutes of the university senate, or summaries of curriculum changes will be summarized for the various programs and courses. Source of the initiative, situation before and after the change will be identified.

Outcomes /changes/improvements

A database of curricular improvements will be maintained. An assigned department faculty member will maintain and review annually in terms of meeting goals and in terms of improving a through k outcomes.

Assessment Tool # 8
A thru k matrix

Data

What data is needed

1) Which courses meet the basic criteria that we strive to develop in our students. These criteria are generally summarized under ABET's Criterion 1. Students and Graduates. Whereas this is an ABET criterion that is directed at the engineering technology students, this particular criterion should be applicable to all students, not just those in ET programs.

2) This criterion states that an engineering technology program must prepare graduates who:
   a. demonstrate an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines,
   b. apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology,
   c. conduct, analyze and interpret experiments and apply experimental results to improve processes,
   d. apply creativity in the design of systems, components, or processes appropriate to program objectives,
   e. function effectively on teams,
   f. identify, analyze, and solve technical problems,
   g. communicate effectively,
   h. recognize the need for and possess the ability to purse lifelong learning,
   i. understand professional, ethical, and social responsibility,
   j. recognize contemporary professional, societal, and global issues and are aware of and respect diversity, and
   k. have a commitment to quality, timeliness, and continuous improvement.

3) Specific program educational objectives covering most or all of a thru k above will be developed as well to specify requirements for students in each program.

Where data comes from

Review of all course syllabi objectives for student learning. Each learning objective will be listed on the course embedded assessment matrix (Tool 5) with a description of how the objective will be assessed during the course.

When data should be gathered and by whom

1) This data should be gathered from review of course syllabi and updated each semester. In most cases it should not change. Significant changes that would require changes to course objectives would generally also require a curriculum change approved through the senate. Therefore, a curriculum change document would, in most cases, be the flag to change the matrix.
2) This should be monitored by the program coordinators.

Use of this data

This data is used to show a summary for quick reference to determine which program courses meet which of the general program objectives as described in the ABET a through k criteria. It is not intended to be used by itself but rather as a summary for tool 5, the course embedded assessments.

Evaluation and Assessment of Data

An analysis of the raw data collected in section I will be used in conjunction with tool 5 in order to maintain the quality of the program. It is expected that the IET, OLS, MET and CGT programs will each track this data separately but in similar format as all courses are used in the other programs and will need to be cross-referenced for each program.

Outcomes / changes / improvements

The program coordinators will review and summarize the overall program in terms of it attaining its goal of meeting the stated program learning objectives. Changes in curriculum may prove to be needed from this analysis. If particular courses need changing the program coordinator and course lead instructor should take appropriate action.

Assessment Tool # 9
SME CMfgT Exam

Data

What data is needed

1) Comparison between PUC pass rates and national student pass rate
2) Percentage of questions correct in the various MET and IET subject areas vs. time and cumulative.

Where data comes from

1) MECI Examination analysis

When data should be gathered and by whom

1) SME student chapter advisor
2) May and December of each year
3) Requires typing results onto a spreadsheet

Use of the data

1) Graph and tabulate to support A thru K subject mastery
2) Comparison of pass rate with national average

Correlation to program and department goals

1) Demonstration data for TC2k Criterion I: a, b, f, h, k
2) Program Educational Objectives: Not Yet Available
3) Department Goals: Not Yet Available

Alternate exams

1) GRE
2) NICET MET or MFET exam
3) CEI exam (SME)
4) Quality
5) Fluid power
6) CPIM, etc. (APICS)
7) FE (EIT)
8) AutoCAD certification exam

Evaluation and Assessment of Data

Data on the last SME exam results comes from the Manufacturing Engineering Certification Institute (MECI) 4 to 6 weeks after the exam date (early May and December). The results in each topic area (% correct) will be entered into a database (spreadsheet) by the assigned faculty member.

Outcomes / Changes / Improvements

Results of the exam will be shared with faculty teaching the course covering the corresponding material. Students in the senior project survey course will be asked for feedback on how their preparation and exam performance might be improved. This tool will serve as a trigger for generating program improvement initiatives and provide data related to relative student knowledge outcomes for certain areas.

Assessment Tool # 10
Advisory Board Input

Data
What data is needed

1) Input to curriculum
2) Input regarding the latest trends in industry

Where data comes from

Advisory board meetings held either once a year or more often as necessary.

When data should be gathered and by whom

Current METS program coordinators should take minutes at all meetings.

Purpose for collecting this data

Align education with industry needs.

Correlation to program and department goals

Not yet available.

Evaluation and Assessment of Data

An analysis of the minutes collected in section I will be completed and made available as needed by assigned faculty or staff.

Outcomes / changes / improvements

This tool should consist of a summary showing what changes, outcomes, or improvements were made as well as planned changes based on the suggestions of the committee. This should be completed by the program coordinators at the end of each academic year.