Incorporating Outcome-Based Assessment Processes into a Construction Curriculum

G. Bruce Gehrig, Ph.D., P.E. and Anthony L. Brizendine, Ph.D., P.E.
University of North Carolina at Charlotte
Charlotte, North Carolina

Within higher education accreditation, both content-based and outcome-based criteria and processes can be found. Outcome-based accreditation requires programs to demonstrate graduates' proficiency based on the established standards while content-based accreditation focuses more on what inputs are necessary to assure proficiency such as the number of instructional hours devoted to particular topics. Although content-based accreditation has been the traditional form of accreditation used successfully for decades, recent trends have shown a move towards outcome-based criteria and processes by many regional and specialized accreditation bodies. The shift is driven, in part, because the greater flexibility afforded by outcome-based accreditation makes it more amenable to continuous improvement processes that allow programs to be more readily modified to strengthen topical areas. The University of North Carolina at Charlotte's Department of Engineering Technology employs an outcomes-based continuous improvement process for three ABET-accredited engineering technology programs and is exploring incorporation of these processes into a new construction management program which intends to seek ACCE accreditation. This paper describes the curricular continuous improvement process used, presents an individual course assessment tool that is used to drive the overall process and highlights how the process could be adapted to work within a content-based accreditation construction management curriculum.

Keywords: Assessment, Accreditation, Construction Education, Continuous Improvement

Introduction

In an effort to improve quality, boost productivity and increase profitability, over the last several decades businesses and corporations have adopted and implemented a variety of continuous improvement plans and processes. These processes allow companies to adapt more quickly to changes in the marketplace and to more readily identify and correct deficiencies within their operations. In order to ensure that graduates have the required skills necessary to be competitive in today's global economy, higher education and many regional and specialized accreditation organizations in the United States have more recently begun to adapt many of the same continuous improvement processes found in industry to their own operations.

At the program level, this move towards continuous improvement processes has been spurred by many of the numerous specialized accreditation agencies. As a result, the University of North Carolina at Charlotte's (UNC-Charlotte) Department of Engineering Technology has implemented an outcomes-based continuous improvement process to assist in achieving program excellence for three Technology Accreditation Commission (TAC) of ABET accredited engineering technology programs. The Department is exploring implementation and incorporation of these processes into a new construction management program which intends to seek American Council for Construction Education (ACCE) accreditation.

However, this effort to adapt our ABET processes to ACCE accreditation is not intended to imply a bias towards ABET accreditation. In fact, when given the choice between pursuing ACCE or ABET accreditation for the new construction program, the Department made a deliberate and conscientious decision to pursue ACCE accreditation. This decision was based on the belief that ACCE accreditation brings an added level of prestige and industry acceptance to a construction program. This added prestige stands as a testament to the effectiveness of ACCE's efforts in establishing and promoting construction management as a viable educational degree and profession within the United States.

This paper first describes the curricular continuous improvement process in general and presents an individual course assessment tool that is used to drive the overall process. It then highlights how the process could be adapted to work within an ACCE-styled construction management curriculum. The overall goal is to describe a continuous improvement tool that we believe can be used to support (not replace) ACCE accreditation processes.

Outcome-Based versus Content-Based Accreditation Processes

Currently within higher education two general categories of accreditation criteria and processes can be found; outcome-based and content-based. Outcome-based accreditation requires programs to demonstrate that graduating students have attained sufficient proficiency in a prescribed set of skills. How the student obtains those skills is essentially left to the discretion of the program. On the other hand, content-based accreditation tends to be much more prescriptive, mandating the number of instructional hours that a program must devote to a particular set of curricular topics. The underlying assumption is that the mandated curriculum will provide the desired set of student skills at graduation. In essence, outcome-based accreditation is primarily concerned with the program output (what graduates can do) while content-based accreditation is focused on the program inputs (what students are taught, how much, etc.).

Although content-based accreditation has been the traditional form of accreditation used successfully for decades, recent trends have shown a move towards outcome-based criteria and processes by many regional and specialized accreditation bodies. This move towards outcome-based accreditation started in earnest in 1988 when the U.S. Department of Education issued regulations that requires accrediting organizations receiving federal funds to include "evidence of institutional outcomes" in the criteria for accreditation of colleges and universities (Palomba & Banta, 1999). As a consequence, it is no longer sufficient for institutions of higher education to merely assert that their educational process has resulted in student learning but instead must demonstrate that students have indeed achieved the desired learning outcomes (Hatfield 2001). This outcome-based approached was further reinforced by such actions as the National Association of State Universities and Land-Grant Colleges explicit statement against the use of content-based processes by accreditation bodies. (NASULGC, 1997). Following the lead of regional accreditation, many specialized accreditation bodies, such as ABET in 2000, have begun to adopt similar outcome-based processes.

Table 1

TAC of ABET Construction Engineering Technology Program Criteria (ABET, 2006)

Associate degree programs must demonstrate that graduates are capable of:

a. utilizing modern instruments, methods and techniques to implement construction contracts, documents, and codes;
b. evaluating materials and methods for construction projects;
c. utilizing modern surveying methods for construction layout;
d. determining forces and stresses in elementary structural systems;
e. estimating material quantities and costs; and
f. employing productivity software to solve technical problems.

Baccalaureate degree programs must demonstrate that graduates, in addition to the competencies above, are capable of:

a. producing and utilizing design, construction, and operations documents;
b. performing economic analyses and cost estimates related to design, construction, and maintenance of systems in the construction technical specialties;
c. selecting appropriate construction materials and practices;
d. applying principles of construction law and ethics;
e. applying basic technical concepts to the solution of construction problems involving hydraulics and hydrology, geotechnics, structures, construction scheduling and management, and construction safety; and
f. performing standard analysis and design in at least one recognized technical specialty within construction engineering technology that is appropriate to the goals of the program.

The difference in the two approaches can be illustrated by comparing ABET's outcome-based criteria for construction engineering technology provided in Table 1 (ABET 2006) to ACCE's content-based criteria for construction management programs listed in Table 2 (ACCE 2006). Under ABET's outcome-based approach programs are free to structure their curriculums in any manner desired as long as they can demonstrate that graduates are capable of the specified outcomes. On the other hand, the more prescriptive ACCE approach provides programs less flexibility in how they structure their curriculum as they must verify that the required instructional hours for each specified topical area are being delivered.

Table 2
ACCE Construction Management Program Criteria (ACCE, 2006)

Topical Category[1]	Semester Hours	Quarter Hours	Instructional Hours
General Education	**15**	**22**	**225**
Communication [Oral and Written][2]	8	12	120
Ethics[2]	1	1.5	15
Mathematics and Science	**15**	**22**	**225**
Physical or Environmental Science [analytical]	8	12	120
Statistics and/or Mathematics	3	4	45
Business & Management	**18**	**27**	**270**
Economics			
Accounting			
Principles of Management			
Business Law			
Construction Science[3]	**20**	**30**	**300**
Design Theory	3	4	45
Analysis and Design of Construction Systems	6	9	90
Construction Methods and Materials	9	9	90
Construction Graphics	1	1.5	15
Construction Surveying	1	1.5	15
Construction[3]	**20**	**30**	**300**
Estimating	3	4	45
Planning and Scheduling	3	4	45
Construction Accounting and Finance	1	1.5	15
Construction Law	1	1.5	15
Safety	1	1.5	15
Project Management	3	4	45
Minimum Required Hours	**120**	**180**	**1800**

[1]Topical subjects, not shown, are prescribed for each topical category. However, no instructional hour requirements are attached to the subjects.
[2]Must be integrated throughout construction-specific curriculum
[3]Combined Construction Science and Construction must be at least 50 semester hours, 75 quarter hours or 750 instructional hours

It must be noted that ACCE accreditation standards are not exclusively content-based and also contain an outcome-based component. Section 9 of the standards, entitled *Program Quality and Outcome Assessment*, requires programs to have academic quality plans that empirically assess the stated outcomes of their programs (ACCE 2006). However, unlike ABET accreditation, ACCE standards do not explicitly state or establish the basis or criteria for the program outcomes.

Because of the greater flexibility afforded, outcome-based accreditation lends itself more easily to continuous improvement processes. If a weakness is identified in graduates' abilities in a specific area, the curriculum can be readily modified to strengthen that topical area. In addition, if new industry trends emerge, say alternative delivery methods, the curriculum can be modified accordingly. Such modifications may require shifting resources and time from topical areas deemed less critical to those considered more critical. Content-based accreditation makes such shifting of instructional time difficult without upsetting the delicate credit hour balance required to maintain accreditation.

Curricular Continuous Improvement Process Framework

As the purpose of this paper is to discuss curricular continuous improvement process in general, the complex details, processes and institutional terminology found in the Department of Engineering Technology's continuous improvement plan are not included in their entirety herein. It should be noted that any continuous improvement plan must be tailored to fit specific institutional and program goals and processes and, therefore, UNC-Charlotte's ET Department's plan may not be directly transferable to other institutions. However, an overall framework is provided in an effort to facilitate the development and adoption of similar, but institutionally distinct processes elsewhere.

The curricular continuous improvement process starts with the establishment of program educational objectives. These objectives describe the desired skills of a graduate three to five years after graduation. These skills represent the combination of formal instructional training received at the university and the initial on-the-job entry-level experience gained by the graduate during their first several years of industry employment. At this stage the graduate should be a competent industry professional. Clearly, programs have little or no control over the training graduates receive after graduation. However, the purpose of the program educational objectives is to insure that graduates have received the prerequisite university-level instructional training necessary for them to be successfully trained by industry. Based on industry feedback, programs can adjust their curriculums to better support industry training efforts. The concept is similar to an instructor teaching a course with an established prerequisite and, based on student performance in the class, determining it is necessary to modify or upgrade the prerequisite course content in order to improve student performance.

The next step is the establishment of program outcomes. These outcomes are concise statements that incorporate and map to accreditation criteria and describe the desired skills of a student upon graduation from the program and university. In order to support the achievement of these program outcomes, course outcomes are established for each course within the domain of the program curriculum. A graphic illustrating how the course outcomes support the program outcomes which in turn support the program education objectives is provided in Figure 1.

Once the educational objectives and outcomes have been established, the key to any continuous improvement process is the development of appropriate assessment mechanisms. Determining what to measure, how to measure it and when to measure it is often the most difficult part of creating a continuous improvement process. For example, one of the Department's program objectives states that an engineering technologist should be able to generate creative and realistic solutions to defined problems and projects. How does one measure or assess student performance against such an outcome? Our choice was to assess this outcome based on three performance criteria:

1. Solve structured technical problems
2. Solve technical problems to satisfy a given set of specifications
3. Develop alternate strategies to solve open-ended problems

In a like manner, performance criteria have been established for each of the program outcomes. After the performance criteria were establish, specific assessment tools were identified and selected to compare student competencies against the criteria. A list of Departmental assessment tools are shown in Table 3.

Table 3
Departmental Program Outcome Assessment Tools

Archival Records:
Biographical, academic, or other file data available from college – e.g., GRE scores, professional society attendance, etc.

Exit Interview:
Specific questions that ask individuals to share their perceptions about the target of study – e.g., their own skills/attitudes, skills and attitudes of others, or program qualities – in a face to face dialog with an interviewer.

External Evaluator:
Any non-student participant in the evaluation process. An external evaluator may be a department, college or university faculty member, a member of the advisory committee, or an industrial representative who has agreed to serve in this capacity.

Observation:
Direct observation of student skills in a laboratory or classroom setting. Observation measurements involve a binary (yes/no) assessment of student performance for a particular action while performing a particular task to be defined by all faculty involved in course instruction.

Peer Evaluator:
Any student participant in the evaluation process who is enrolled in the course. A peer evaluation may be performed to assess teamwork skills of teammates and/or may provide feedback on individual and/or team presentations.

Performance Appraisal:

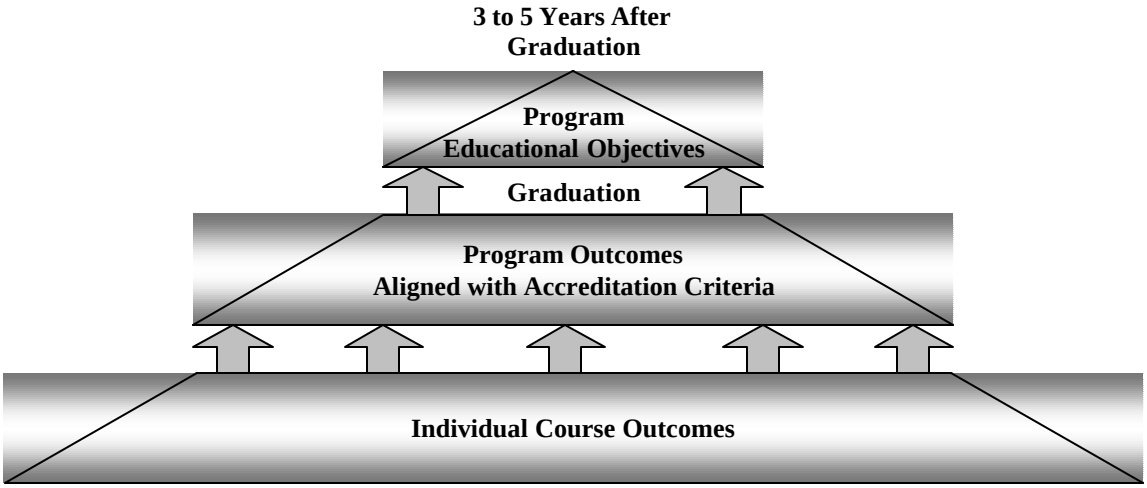

Figure 1: Hierarchy of Course Outcomes, Program Outcomes and Educational Objectives

Subjective analysis of skill(s) and/or knowledge through consideration of student submission. The appraisal may be performed by the faculty member teaching the course, or may be performed by a party external to course instruction. Subject to agreement by all faculty responsible for teaching a particular course, appraisal may be binary (e.g., yes/no), or involve multiple achievement levels, or "bins" (e.g., a three bin appraisal may involve exemplary, satisfactory, unsatisfactory).

Reference Review:

A qualitative analysis of the number, type and value of resources to be defined by instructors teaching relevant courses.

Survey:

Specific questions on written questionnaires that ask individuals to share their perceptions about the study target – e.g., their own or others' skills/attitudes/behavior, or program/course qualities and attributes. Departmental and/or college surveys will be given to three distinct populations:

- Alumni: All alum from the department are mailed surveys every three years.
- Employer: Employers of departmental alumni are mailed surveys every three years.
- Senior Exit: Before graduation, seniors will meet individually with the discipline coordinator.
- Student: Current students are given annual surveys.

Specific classroom or student activities related to performance criteria were selected as performance measures and evaluated using the selected assessment tool. Any appropriate student work or activity can be used as a performance measures such as homework problems, exam questions, design problems, capstone projects, laboratory exercises, internships, etc. Consideration must also be given to when during the curriculum to measure a particular performance criterion. This decision is based on when during a curriculum a student would be in the best position to demonstrate proficiency on a selected performance criterion and usually corresponds to the last course or activity in a topical sequence. Once a particular performance measure has been selected, the same performance measure is consistently used from year-to-year.

Threshold targets (both the required level of performance and the percentage of students achieving that level of performance) were established for each performance criterion or measure in order to establish a baseline to monitor student performance over time. If a sufficient number of students met or exceeded the established threshold or target for all of the performance criteria under a program outcome, then it was concluded that the overall program outcome had been obtained. Grades were specifically chosen *not* to be a measure as any grade is based on a variety of weighted factors that encompass more than just the performance criteria being measured. For example, partial credit is often given when assigning grades on homework or exam problems, thus allowing a student to receive a passing or higher grade although they may not have gotten the final answer correct. In such a situation, whether or not the student has really mastered the ability to solve a structured technical problem is debatable. Therefore, it is possible for a student to receive a passing grade for an assignment or class but have been assessed as failing to meet the target for a particular program outcome measure.

Once the measures and assessment tools have been established, the real work of continuous program improvement can begin. The assessments are typically performed at the individual course level by the course instructor. At the end of each semester, instructors compile their assessment results using a prescribed reporting format (described in more detail in the subsequent section of this paper). The reports are then forwarded to a faculty committee that evaluates the data as well as input from industry and alumni and makes recommendations for curricular improvements if any weaknesses in student performance are found. This feedback

loop is the critical link in driving and sustaining the continuous improvement process. Enhancements and changes can occur based upon actual measured performance rather than as a result of instructor intuition. As a result, the process allows faculty to identify problems based on hard data and to make focused and targeted changes. A schematic of the basic process is given in Figure 2.

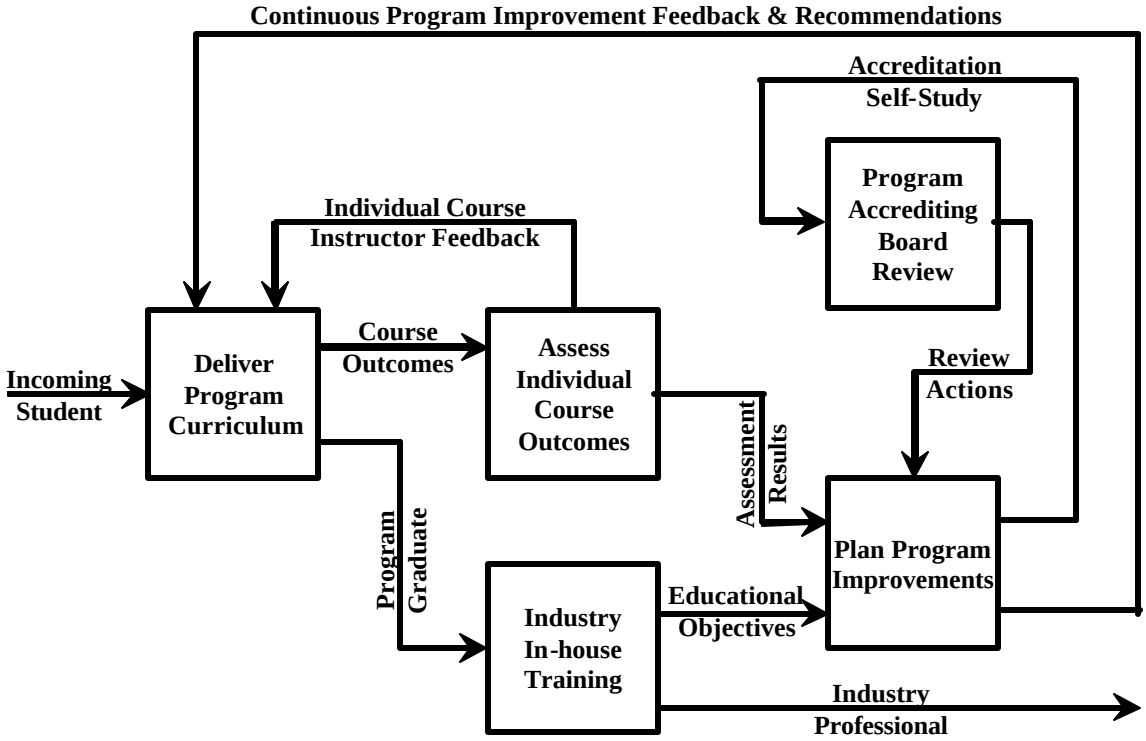

Figure 2: Outcome-based Continuous Program Improvement Process Schematic

As can be seen, outcome-based accreditation boards are primarily focused on ensuring that an adequate continuous improvement process is in place and that graduates are making sufficient progress towards achieving the program outcomes. Once the continuous improvement process is established, programs are expected to demonstrate that the skill level of graduates have shown continuous improvement over time. In concept, programs, no matter how high in quality, are not allowed to simply maintain the status quo but must strive to continuously improve.

A Proposed Individual Course Assessment Instrument

In order to facilitate the assessment process, the Department of Engineering Technology developed an Individual Course Assessment Process (ICAP) form that provides a consistent format to document assessment results. A truncated version of an actual completed ICAP has been included in the appendix of this paper. The outline for the form includes the following sections:

A. Course Assessment
B. Program Outcome Assessment

C. Recommendations
D. Assessment Tools
E. Assessment Check Sheet

The course assessment section lists the objectives and learning outcomes established for the course. The course objectives typically reflect the official course catalog description. Course learning outcomes describe what a student will be able to do upon completion of the course. The course coordinator, in consultation with the program faculty and instructors, has the responsibility for establishing the course learning outcomes. Based on feedback received from the continuous improvement process, the learning outcomes are modified to address specific student needs and strengthen program outcomes.

The program outcome assessment section lists the specific program outcomes and accreditation criteria targeted by the course. It also lists the performance criteria, measures and targets to be used as part of the course. The targeted program outcomes, performance criteria, measures, and targets are established by a Focus Area Improvement Team (FAIT) consisting of the program faculty. Course instructors do not act unilaterally to modify the targeted outcomes, criteria or measures, but rather seek approval from the FAIT. This process encourages active participation and ownership of the curriculum in its entirety by the faculty.

In the example provided, Program Outcome 5 is being targeted which addresses the ability of graduates to recognize the value of diversity, and identify ethical and societal issues in business and technical tasks. This program outcome supports TAC of ABET criterion 2(i) which states that graduates should have the ability to understand professional, ethical and social responsibilities. In order to assess this program outcome, the performance criterion used is the students' ability to discuss ethical and societal issues related to technology. In this example, achievement of the outcome is measured by the students' ability to effectively address an ethical case-study through submission and evaluation of a written report. Therefore, the instructor is *required* to include an ethics case-study written report as part of the course.

Section C includes the instructor's evaluation and recommendations concerning both the course and the assessed activities. In the example given, the actual instructor recommendations have been truncated as the course actually targeted a total of four program outcome performance criteria. Student performance on the ethical case study assignment is analyzed by the instructor as shown in the example. The instructor also discussed the other three assessment measures (omitted due to paper length constraints). But, the recommendation section is not limited to just a discussion of the targeted assessment activities as instructors also include recommendations for general course improvement not tied to specific program outcomes.

It is interesting to note that the recommendations in the example ICAP form demonstrate the effectiveness of the overall continuous improvement process in improving student performance. Based on the prior year's ICAP assessment, additional lectures and focus was placed on the ethical module for the course. As a result, the instructor was able to report that student performance on the ethics case study assignment had improved. Thus, the individual course assessment process proves capable of providing the feedback loop necessary to drive the continuous improvement process.

The assessment tools section of the form is used to provide the actual assignment, problem, and/or exam question used as the measure for the performance criteria. This is done to ensure year-to-year consistency in assessment and data collection. The same measures, or at least very similar ones, must be used every time a particular performance criterion is assessed to assure integrity of the data and make longitudinal comparisons of student performance valid. Again, instructors are not allowed to change the measures without approval from the FAIT committee.

The last section includes an assessment measure check sheet that is used to document the actual assessment results. This is useful if questions arise concerning assessment results during accreditation visits or reviews.

The completed ICAP forms for each course in the curriculum are forwarded to the FAIT committee at the end of each semester. The FAIT committee meets at least once a semester to review the results and to formulate improvement actions. The data from the ICAP forms are also extracted by the Department of Engineering Technology and included in an assessment database that allows overall student performance for each program outcome to be monitored over time. Again, the function of outcome-based assessment is to demonstrate continuous improvement in student performance.

Adapting the ICAP Process to a Construction Curriculum

Although the continuous improvement process and ICAP form presented has been effectively used by the ET Department to satisfy ABET's outcome-based accreditation standards, the current challenge facing the Department is adapting the processes to satisfy ACCE accreditation requirements for its new construction management (CM) program. By adapting the process to ACCE requirements, the Department hopes to avoid unnecessary administrative duplication between the Department's various programs and to use the process to drive curricular improvement within the CM program. In addition, considering the on-going trend toward outcome-based accreditation, it is likely only a matter of time before ACCE adopts outcome-based accreditation standards and criteria and implementing the continuous improvement process now better positions the program to quickly adapt to any such changes.

As ACCE accreditation requires programs to have continuous improvement plans that empirically assess the stated outcomes of their programs, it seems logical that the Department's current processes could be adapted to satisfy this current requirement. Although the program will have to track the number of instructional hours for each topical area to meet ACCE requirements, the ICAP process can still be used to drive curricular improvement. The necessary feedback loop can be created and instructors will still be able to use the feedback on student performance to identify areas in need of curricular improvement. The primary difference will lie in making the changes while maintaining the instructional hour constraint.

Based on experience in developing the current continuous improvement process, however, adapting the process is likely to be a significant task and undertaking. First, it will be necessary to define educational objectives and outcomes that are specific to the CM program's needs and

requirements. Supporting performance criteria and measures will then have to be revised although not in their entirety. For example, the Project Management Technology course for which the ICAP example was provided has become part of the new CM curriculum and no significant immediate changes are planned for the ICAP form. Since ACCE also has an emphasis on ethics, it seems reasonable that the ethics assignment and measure would remain the same. There are many other topical areas common between the ABET and ACCE programs.

The larger challenge will be distributing the ACCE mandatory topical subject areas among the various courses. These topical subject areas must become part of the individual course outcomes. As in the current system, instructors will be responsible to make sure that the topics are included in their syllabi. The FAIT improvement actions will be constrained by the instructional hour and topical category requirements. As the CM program has not yet been accredited, it remains to be seen how easily and effectively integration of ACCE accreditation standards and existing continuous improvement process can be made.

Conclusions

The University of North Carolina at Charlotte's Department of Engineering Technology has implemented an outcomes-based continuous improvement process to assist in achieving program excellence for three Technology Accreditation Commission (TAC) of ABET accredited engineering technology programs. The process utilizes individual course assessment as the vehicle to drive overall program improvement. In order to facilitate and standardize the assessment reporting activities, the Department developed an Individual Course Assessment Process (ICAP) form.

The form systematically establishes the course objectives and outcomes in support of program outcomes, outlines the targeted program outcomes' performance criteria and assessment measures, and documents the assessment tools, results, and recommendations. The tool has demonstrated the ability to provide the feedback loop required to effect continuous program improvement. Although ACCE accreditation criteria is content-based and more prescriptive, with some modifications the existing continuous improvement process may be transportable to the Department's new construction management program which intends to seek ACCE accreditation.

However, this effort to adapt the ABET processes to ACCE accreditation is not intended to imply a bias towards ABET accreditation. Rather, it is an effort to avoid unnecessary administrative duplication between the Department's various programs and to stay ahead of recent trends towards outcome-based accreditation processes.

References

ABET, Inc. (2006, December 27). Criteria for accrediting engineering technology programs – Effective for evaluations during the 2006-2007 accreditation cycle [PDF Document]. URL http://www.abet.org/Linked%20Documents-UPDATE/Criteria%20and%20PP/T001%2006-07%.

American Council for Construction Education. (2007, February 13). Document 103: Standards and criteria for accreditation of postsecondary construction education degree programs [PDF Document]. URL http://www.acce-hq.org/PDF/form103.pdf .

Hatfield, S.R. (2001). The student learning self-study: Choices and opportunities. *New Directions for Higher Education*, 113, 23–33.

National Association of State Universities and Land-Grant Colleges (1997). NASULGC board approves resolution on accreditation. Newsline *6*, 10, p. 8.

Palomba, C.A., & Banta, T.W. (1999). Assessment essentials: Planning, implementing, and improving assessment in higher education. San Francisco: Jossey-Bass.

Appendix

ETCE 3243-001 – Project Management Technology
Fall Semester 2005

A. Course Assessment

Course Objectives: The objective of the course is to provide the student with a working knowledge of the concepts, terminology, and methods associated with construction project management.

Course Learning Outcomes: Upon completion of the course, the student will be able to:

- Describe the basic project delivery processes in engineering and construction
- Identify the essential elements of a construction contract
- Perform basic construction contract administration activities
- Prepare a construction contract for a simple construction project
- Prepare comprehensive construction project schedules
- Analyze the results obtained from Gantt, CPM and other types of schedules
- Use industry software as aids in preparing project schedules

B. Program Outcome Assessment

This course targets the following program outcome and ABET criterion:

Program Outcome 5: Recognize the value of diversity, and identify ethical and societal issues in business and technical tasks.

Performance Criterion 5ii: *Discuss ethical and societal issues related to technology.*
Measure: Percentage of students that effectively addressed an ethical case-study in a written report.
Target: 80%
Results: 70%

ABET Criterion 2(i): "an ability to understand professional, ethical and social responsibilities."

C. Recommendations

Adding an additional lecture on ethical issues appears to have improved student performance in discussing ethical issues. The percentage of students satisfying the goal was below the targeted value because several students failed to turn in the assignment. If only the students who actually turned in the assignment are considered, 87.5% of the students would have satisfied the performance criterion. However, students could still benefit from additional instruction concerning basic ethical concepts and terms such as "conflict of interest", etc.

D. Assessment Tools

D3. Performance Criterion 5ii (Homework Assignment):

1. Download and review the NSPE Code of Ethics

2. Select and analyze one of the following ethical case studies:
   a. Changes in Statement of Qualifications
   b. Protesting a Low Fee Proposal
   c. Services on Same Project
   d. Code Violations with Safety Implications
   e. Serving as Design Engineer and General Contractor

3. Prepare a written essay that summarizes the ethical issues involved in the case study and describes how *you* would respond if placed in the same situation. Your analysis should specifically cite the sections of the NSPE Code of Ethics that you relied on in making your decision(s) on how to respond. An example of the format expected for the case study analysis is given in NSPE Case No 88-1

E. Assessment Check Sheet

Student ID	Measure 1i			Measure 5i			Measure 5ii			Measure 6vii		
	Y	**N**	**NS**	**Y**	**N**	**NS**	**Y**	**N**	**NS**	**Y**	**N**	**NS**
1	☒	☐	☐	☒	☐	☐	☒	☐	☐	☒	☐	☐
2	☒	☐	☐	☐	☒	☐	☒	☐	☐	☒	☐	☐
3	☒	☐	☐	☒	☐	☐	☒	☐	☐	☒	☐	☐
4	☒	☐	☐	☐	☒	☐	☒	☐	☐	☒	☐	☐
5	☐	☐	☒	☒	☐	☐	☐	☐	☒	☐	☐	☒
6	☒	☐	☐	☒	☐	☐	☒	☐	☐	☒	☐	☐
7	☒	☐	☐	☒	☐	☐	☒	☐	☐	☒	☐	☐
8	☒	☐	☐	☒	☐	☐	☐	☒	☐	☒	☐	☐
9	☒	☐	☐	☒	☐	☐	☒	☐	☐	☒	☐	☐
10	☒	☐	☐	☒	☐	☐	☒	☐	☐	☒	☐	☐
11	☒	☐	☐	☒	☐	☐	☒	☐	☐	☒	☐	☐
12	☒	☐	☐	☒	☐	☐	☒	☐	☐	☒	☐	☐
13	☒	☐	☐	☒	☐	☐	☐	☐	☒	☒	☐	☐
14	☒	☐	☐	☒	☐	☐	☒	☐	☐	☒	☐	☐
Totals	**16**	**0**	**1**	**15**	**2**	**0**	**13**	**1**	**3**	**16**	**0**	**1**

Y = Satisfied Measure N= Didn't Satisfy Measure NS = Not Submitted