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*By Dr. Jon M. Duff*

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Dr. Duff is professor of Information and Management Technology at Arizona State University and has authored or co-authored numerous texts on technical and industrial graphics. He was awarded the Laureate Citation by Epsilon Pi Tau, the international honorary for professions in technology, and has been recognized as an Outstanding Professor of Industrial Technology by NAIT.

# Outcomes Assessment across Multiple Accreditation Agencies

***By Dr. Jon M. Duff***

## *Abstract*

The identification, evaluation, and validation of educational outcomes are integral parts of program review and accreditation in technology. Multiple agencies require outcomes assessment as part of their reviews: State legislatures, Boards of Trustees and Regents, institutional accreditations, and discipline-specific accreditations all require some form of this activity. Additionally, programs in technology, engineering technology, and engineering may be organized within the same college or department, often sharing laboratories, courses, and instructors. The diverse requirements of these various agencies for outcomes assessment must be blended in order to increase efficiency and effectiveness. A flexible methodology for outcomes assessment can be developed that, with minor modification, satisfies the requirements of these multiple agencies.

## *Introduction*

Technology and engineering programs are under increasing pressure from accrediting standards, institutional review, and legislative oversight to demonstrate both responsiveness to, and validity of, curricula in meeting the needs of their target professions. Indeed, accrediting agencies such as the National Association of Industrial Technology (NAIT) and the Technology Accrediting Commission-Accrediting Board for Engineering and Technology (TAC-ABET) include outcomes assessment in their accreditation requirements (NAIT, 2004; ABET, 2003). The National Science Foundation, through its Technology Reinvestment Project (TRP), has brought together diverse educational parties, further emphasizing the role of assessment in engineering, technology, and science.

NAIT has a long history of requiring evidence of curricular assessment and takes a non-proscriptive approach. In fact, section 6.16 titled, Assessment (NAIT 2004), states "An assessment plan shall be comprised of, but not limited to, the following for each program: (1) program mission statement, (2) the desired program outcomes/student competencies, (3) evidence that the program incorporates these outcomes/student competencies, (4) the assessment measures used to evaluate student mastery of the student competencies stated, (5) compilation of the results of the assessment measures, and (6) evidence that these results are used to improve the program." In other words, NAIT doesn't proscribe appropriate outcomes. Instead, it requires evidence and validation of process.

TAC-ABET accreditation has historically emphasized credit hours in specific courses without promoting assessment of outcomes. Since 2000, however, TAC-ABET has emphasized assessment as an important aspect of program accreditation through its eleven (A through K) proscribed outcomes.

Technology and engineering have strong histories of creating outcomes-driven curricula; because they share technical subject matter, it would be advisable that assessment processes implemented in one might easily be adapted for the other. In practice, however, outcomes may be identified, evaluated, validated, and implemented using methods required by internal (institutional) and external (accreditation body) review, and are incompatible.

Outcomes assessment must be an integral component of technology education. Even if previous accredita-

tion reviews did not identify or assess outcomes, existing curricula can be evaluated, creating first-order outcomes with a measure of face validity. These outcomes can then be subjected to further evaluation by faculty, students, graduates, and industrial advisory committee members in order to arrive at a workable number. This continual review and modification establishes additional validation. By documenting where such validation activities actually impact the curriculum, the assessment loop is closed, a process that institutional review and accreditation agencies insist upon.

## *Purpose*

This paper addresses a fundamental question: Can proscriptive outcomes such as those defined by TAC-ABET be applied to the NAIT 2004 accreditation standards? If so, what methodologies exist to facilitate this?

## *Methodology*

Knowing that NAIT and TAC-ABET both require the identification and assessment of educational outcomes—that technical programs accredited by both may exist side-by-side within institutional units—the question is raised as to how accreditation activities of one might compliment the other.

At Arizona State University, three NAIT accredited programs are housed along with four TAC-ABET programs in the College of Technology and Applied Sciences. Assessment activities for NAIT and TAC-ABET may occur at the same time, often sharing faculty, and in some cases, courses.

Ward and Dugger (2002) acknowledge the importance multiple agencies place on outcomes assessment in accreditation activities. This synergy is especially true when automated assessment tools can be shared by programs having different accrediting bodies. For example, although a technology degree may be accredited by NAIT, several courses considered in the NAIT accreditation may be included in ABET curricula and subject to ABET review.

A potential solution is to transpose NAIT outcomes and their assessments to match ABET's A-K outcomes via a Web-based automated tool (True Outcomes, 2003). This points out a significant benefit of engaging in an outcomes assessment process: Once identified and validated, educational outcomes can be used in a variety of ways, including the repurposing into another accreditation system. Analyses of the Engineering Criteria 2000 outcomes assessment process has appeared in the proceedings of several recent ASEE annual meetings (McGourty, 1999; Besterfield-Sacre, 2000) as well as in the pages of *The Journal of Engineering Education* (Felder, 2003) and in no case is the TAC-ABET process at odds with NAIT accreditation standards.

Technology programs that cohabitate with engineering programs may not fit precisely into ABET's more proscriptive A-K outcomes. Ironically, service courses may profit more from an outcomes approach than courses in the home department because it is by identifying and validating outcomes that service courses become indispensable building blocks in the curriculum as a whole. It is the way that technology courses may be accepted by TAC-ABET in the future.

Even though identifying, assessing, and validating outcomes has been a topic of discussion in higher education for over a decade, many university faculty may still be unfamiliar with the process. The American College Testing (ACT) Program sponsored a project to develop measures of outcomes assessment validity as early as 1991 (Lutz, 1992) and literature on the subject is easily found even a decade earlier. Rogers and Sando (1996) developed extensive assessment guidelines as part of an NSF grant that is still in use today.

Interestingly, some see requiring outcomes assessment of all faculties as an assault on academic freedom. Indeed, in a milieu of increasing demands on faculty time, and with diminishing university resources, a case can be made that requiring assessment of all courses is simply an unfair burden. This is especially true in technology and engineering where many course topics are born, live, and die in a space of time shorter than needed to identify and validate their outcomes.

Technical faculties have already done much of the work in starting an outcomes assessment because most technical courses:

- Are based on observable, measurable actions by faculty and students.
- Use measurable course objectives.
- Are task-based and these tasks have identifiable outcomes.
- Use industrial advisory committees and exit interviews of graduates as the bases for validation.

Therefore, most technical courses have much of the preliminary work done to begin a vigorous outcomes assessment. The first step is to put what you already have into a form that is recognizable as outcomes assessment.

### Outcomes and Assessment

It is helpful to arrive at an operational definition of both *outcomes* and *assessment*. Seattle-based New Horizons for Learning (Anderson, 2000) defines an outcome as "an operationally defined educational goal, usually a culminating activity, product, or performance that can be measured."

Outcomes spring from the operational missions of the university, the college, the department, and the program. By having focused, unambiguous mission statements one can determine whether outcomes match missions and whether missions are appropriate in light of curriculum. It is counter-productive to have a curriculum that does an excellent job of 'X' when you are charged by the university to do 'Y.' It also is inadvisable to have a 'Y' mission when all assessment validation says you should be doing 'Z'.

Outcomes can be thought of as the ISO 9000 standards of education because like ISO 9000, the outcomes assessment process is not fundamentally proscriptive—even in the case of TAC-

ABET (Waks, 1999). There are three elements that describe how outcomes assessment functions: what *is* being done, what is *said* is being done, and what *should* be done. Outcomes assessment is the tool that reveals when these three elements are the same. When they match, a curriculum is working. When they do not match, the curriculum is dysfunctional. It is not enough to simply identify outcomes. They must be appropriate, valid, and measurable in their attainment. Again, from New Horizons, assessment is defined as:

> …the process of observing learning; describing, collecting, recording, scoring, and interpreting information about a student's or one's own learning. When most useful, assessment is an episode in the learning process; part of reflection and autobiographical understanding of progress. Traditionally, student assessments are used to determine placement, promotion, graduation, or retention (Anderson, 2000).

Outcomes assessment is more formative that summative. That is, it should guide dynamic curriculum design first, while providing necessary documentation. Accreditation agencies, because they are not privy to the inner workings of a curriculum, require a summative report of assessment activities and from this summation. From this they will infer that formative benefits do or do not exist.

It is important to assume healthy skepticism when embarking on a program of outcomes assessment because, in the end, outcomes assessment does not do everything (Ehrmann, 1999), nor does it even do some of the things it purports. However, a good starting point may be to review "The 9 Principles of Good Practice for Assessing Student Learning" found on the AAHE Web site (Astin, 2003). A synthesis of these nine principles reveals that outcomes assessment may be thought of as "the *systematic* and *documented* analysis of the educational process and its effectiveness." The two italicized words in this statement bear discussion.

**Systematic Analysis**

Systematic analysis is regular and follows a proscribed methodology and is concerned with both validity and replicability. You want to do what you say you are doing and you want to do it in a way that can be compared over time. Accreditation agencies will want to see both the results of the process and evidence of the process itself. This means that every faculty member must build outcomes assessment into course development, revision, and evaluation.

**Documented Analysis**

It's not enough that to be doing what you say you are doing, clear documentation of this must be provided. For example, course proposals should take on a standard format that includes outcomes-based justifications. The revision history of each course should point back to justifications based on assessing the outcomes.

## *Findings*

Outcomes assessment is an educational management tool. It establishes a measure of curricular validity and effectiveness that is faculty, student, and employer-driven. It provides (when correctly documented) a longitudinal measure for program development. It can also provide students with a record of curricular achievement in the form of "learning portfolios," helpful in employment. The Department of Economic Geography at the University of Washington provides their students with an excellent resource for creating learning portfolios that could be an important aspect of outcomes assessment (University of Washington, 2003). At Arizona State University, the server-based application True Outcomes forms a bridge between NAIT and TAC-ABET assessment requirements and has a strong learning portfolio component. An effective management tool, combined with student learning portfolios, may increase the chances for a dynamic, responsive program. However, outcomes assessment accomplishes several additional and potentially more practical ends.

First, it provides evidence to accrediting bodies. If an accreditation agency requires outcomes assessment and it is important to gain this agency's approval, outcomes assessment completed can assure that a curriculum meets, with some customization, this requirement. Second, assessment is responsive to mandates from legislatures and Boards of Trustees or Regents. Legislatures are becoming more and more concerned that appropriations be spent efficiently. Pressure applied from the legislature on their governing boards—and then applied to university administrators—means that programs that do effective outcomes assessment may be the ones who survive.

**Uses for Outcomes Assessment**

If outcomes assessment is not proscriptive, neither should it be used to evaluate performance to a standard. It represents the consensus of faculty, students, and employers and is responsive to using a "Delphi technique" to arrive at consensus. If university administrators proclaim outcomes by fiat, it is a misuse of the method. Likewise, if faculties assume outcomes without justification and validation, it is likewise a misuse.

Outcomes assessment is responsive to technological change. Implemented correctly, it may even predict the need for change in advance. This is particularly important with curricula dependent on up-to-date laboratories and computing. When industry validates outcomes, the loop is closed, and valuable planning information can be gathered. For example, it would be beneficial to know that industry is contemplating a wholesale change from one method or tool to another well in advance of the actual change. With an active outcomes assessment these trends may be identified and preparations made.

Outcomes assessments done for the pragmatic reasons of accreditation or legislative reporting are much too broad to actually be of use at the course level. Outcomes for a course may number a dozen or more; outcomes for a degree curriculum may number in the hun-

dreds. ABET's eleven (A-K) outcomes are a general description of an engineering or technology graduate. They form a baseline for NAIT outcomes assessment. However, these eleven outcomes are much too vague to have any impact on what is done at the course level. To do that, the course-specific objectives must be associated with the program outcomes as shown in Figure 1. The mission is the broadest statement, followed by program outcomes, then by course objectives, and finalized by course competencies.


***Figure 1. Program outcomes are derived from missions and reflect course objectives.***

**Dangers of Outcomes Assessment**

Given the many positive aspects of outcomes assessment, dangers remain in its misapplication. In his 1998 presentation to the American Association for Higher Education, Stephen C. Ehrmann (1999) pointed out that to focus on the positive results from assessment masks underlying problems, such as how dissimilar outcomes can be compared. Additionally, outcomes assessment should not be used to evaluate faculty. That is, whether or not certain outcomes are being met should not be used as the basis for promotion, tenure, or remuneration. There are several reasons for this:

- *Measures of outcomes assessment are inappropriate*. Many times whether or not a given outcome is achieved is the composite effect of many courses, many teachers, and variables outside the faculties' control.
- *There is no norming of outcomes*. There is no way of comparing faculty member X with faculty member Y. There is no way of comparing success last year with success this year. There is no way of comparing department Z with department W.
- *Outcomes may change so rapidly that evaluation is meaningless*. Because outcomes assessment provides only a snapshot of the curriculum at a given point, using success of meeting outcomes to evaluate faculty will be inherently unfair. Successes and failures may be overlooked or incorrectly recognized.

**Initiating Outcomes Assessment**

It may be helpful to see how a faculty becomes involved in outcomes assessment. Most will start with a curriculum already in place, with greater or lesser potential for identifying outcomes.

Begin with an analysis of the courses in the existing curriculum. Gather all course outlines (syllabi) and compile all behavioral objectives or competencies. It may be helpful to do this in a spreadsheet and assign descriptors so that the data can be mined for various traits. For example, it may be helpful to categorize the competencies as *theory, practice,* or *application*. This is particularly suited for technology where theory (lecture) is often separated from its practice (laboratory) and subsequent application (internship, co-op, capstone project).

It is difficult to differentiate between instructional objectives, competencies, and outcomes. Two criteria may help in this matter: 1) the level of detail in the specification, and, 2) the intent of the specification (Harden, 2002). An outcome should have considerably less detail than does an instructional objective. It should guide a block of related courses as opposed to a block of course activities.

Analyze each course to determine: 1) that competencies listed in the syllabi are actually taught in the course, and 2) that these competencies are, in fact, valid. The fact that a professor included the material in the course is a form of low-level face validity. One can assume, usually with a fair level of confidence that the professor teaching the course is, if not an expert in the field, at least very knowledgeable. But input from students, graduates, an Industrial Advisory Board, and employers adds to this validity. Before competencies are added to the list of potential outcomes, these individuals should review them.

Observe the material in Table 1 (see page 6). In it, you may see the relationship of course competencies (of which there are many), with course objectives (of which there are fewer), to program outcomes (of which there are only a very few).

**Sequencing**

It may be helpful to apply Blooms affective, cognitive, and psychomotor taxonomy to outcomes (Anderson, 2000). In technology, the affective domain (arguably the most difficult for which to construct and assess valid outcomes) plays a secondary role. Cognitive and psychomotor can be evaluated based on their of abstraction defined by:

- *Theory*-understanding the outcome's broad conceptual bases
- *Practice*-controlled experiences that build skills and understandings
- *Application*-open ended experiences that demonstrate outcome mastery

Identifying and validating outcomes may be enough for accrediting agencies and state legislatures. A more micro approach is needed for the actual work of determining the competencies in a particular course, and in what order they should be presented. The matrix in Figure 2 shows a portion of university general studies outcomes where competencies are listed by course in the left hand column, the courses themselves are placed across the top, and an identification of theory, practice, or

application is assigned at their intersections. You may see that in Humanities and Fine Arts, "explore questions of human experience and expression" is presented theoretically in Humanities courses and practiced in Social and Behavioral Sciences courses. In this case, it is important to sequence the Social and Behavioral Sciences courses after Humanities and Fine Arts offerings so that practice could follow theory.

The question remains: "how many outcomes are enough?" Accrediting agencies generally encourage a limited number of separate outcomes—ten to twenty. However, curricula often require considerably more, fifty, possibly over one hundred. The answer is to create a collapsed hierarchical version, as shown in Figure 3. The curriculum committee uses the full list; the collapsed list is used for accreditation.

**Assessment Measures**

Identifying, distilling, and documenting outcomes is only the first part of an outcomes assessment. It can be the most formidable because to be successful (both practicably and in terms of satisfying the criteria of accreditation) an entire faculty must be involved. All faculties must critically look at the competencies for each course, edit as necessary, and submit the outcomes to someone whose ultimate responsibility it is to distill the data. The distilled outcomes must:

- Match university, college, and departmental missions.
- Favorably benchmark with peer programs at other institutions.
- Achieve face validity with current teaching faculty.
- Record the history of curriculum actions, especially in how student, employer, and advisory board input affects outcomes.
- Be validated by external consultants or experts.
- Achieve external validity through advisory boards and employers as Glotzenbach (1997) suggests. Convene regular advisory board meetings and systematically gather and analyze data on the board's evaluation of mission, outcomes, and competencies.

***Table 1. Course Objectives and Competencies Are Derived From Their Educational Outcome***

Educational Outcome

Graduates of the GIT program will be able to create accurate digital models.

Course Objectives

GIT 210 Using simple pencil and paper, demonstrate the ability to sketch accurate multiview, pictorial, and diagrammatic representations of actual objects, visual, and verbal descriptions.

Competencies

1. Given a verbal description of a spatial condition, demonstrate the ability to sketch both multiview and pictorial representations.
2. Presented with a manufactured part, sketch accurate proportional multiviews and pictorials.

GIT 312 Using an industry standard digital modeling tool, demonstrate the ability to analyze manufactured products and apply appropriate modeling strategies to their digital description.

Competencies

1. Translate standard engineering views into a hierarchical pictorial modeling diagram.
2. Translate a modeling diagram into primitive, loft, lathe, extrusion, NURBS, and Boolean components.


***Figure 2. Elements of theory, application, and practice are recorded in a matrix of educational outcomes.***


***Figure 3. The outcomes matrix collapsed for accreditation purposes.***

- Reflect the input of current students and alumni (Parker, 1992) This can be done by having alumni evaluate student portfolios (Scott, 1999).
- Compare favorably with national guidelines. Submit the curriculum for accreditation.

## *Implications*

Because outcomes assessment is only

a snapshot of an educational program, curricula, like industry, is subject to a regime of continuous improvement. As Kearney (1997) points out, it isn't something that you do six months before your next accreditation visit. To be effective, outcomes assessment must be woven into the fabric of course design and curriculum revision. In other words, the task is never done.

There are such significant positive aspects to outcomes assessment that it is a wonder that any faculty remain resistant to implementing it, at least in some form. It assures continuous curricular evaluation. In technology and engineering it answers many of the questions concerning *what* should be taught and *when*. It provides a method for checking the validity of a curriculum and its courses. It encourages students to be actively involved in their education by continuously evaluating the effectiveness of courses and curricula. It assures close relationships with Industrial Advisory Boards that will close the assessment loop. It satisfies the requirements of accrediting bodies. And in an environment of circumspect support from legislatures, it provides evidence that a curriculum is current, responsive, valid, and a worthy recipient of the public's investment. The fact that outcomes assessment must be done for multiple agencies makes it even more important and in a final analysis, to potential to be even more effective.

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