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Implementation of Program Assessment in a Technical Department

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Introduction and Background

Program assessment, quality assurance, and continuous improvement have become essential elements of the accreditation process. National higher education associations, such as The Higher Learning Commission of the North Central Association, mandate ongoing evaluation and assessment as a "core component" of the institution (The Higher Learning Commission, 2003). The Commission further noted the "need to create a culture of evidence (p. 3.2-7)" based on quality improvement principles to drive institutional assessment.

Assessment and accountability are issues that higher education institutions have confronted during the last 15 years (Frye, 2002). As far back as 1988, federally approved accrediting organizations were mandated to include evidence of institutional outcomes in their criteria for accreditation (Reeves & Reeves, 2002). Often the terms assessment and accountability are used interchangeably by the public. Government officials and the public continue to place demands on higher education for accountability in days of tight budgets. Consequently, assessment is often linked to accountability and conjures up thoughts of return on investment of tax dollars. However, Frye (2002) points out that assessment and accountability have important differences. Frye defined assessment as a "set of initiatives we take to monitor the results of our actions and improve ourselves" and accountability as a "set of initiatives others take to monitor the results of our actions."

For approximately two decades, debate continued in higher education as to whether assessment should focus on accountability or improvement. Today, most institutions have come to realize that the political and economic reality of it all is that assessment should include both (Angelo, 1999; Strong, Amos, & Callahan, 2003). However, Angelo (1999) indicates that improving learning still matters most. Regardless, effective assessment is a means to improve programs and show the public that the educational system is being held accountable. Recognizing this potential, assessment has been included in not only professional accreditation standards, but institutional program reviews and government regulatory reports as well (Reeves and Reeves, 2002). This has caused a major expansion of interest and effort with regard to assessment.

After approximately fifteen years of effort by regional and programmatic accrediting agencies to improve the assessment process, some institutions still struggle when it comes to meeting the assessment standards (Reeves and Reeves, 2002). A number of recent presentations and publications (Diez, Huang, Holten & Yearwood, 2002; Reeves and Reeves, 2002; Freeman & Field, 2003; Sarapin, 2003; Strong, Amos, & Callahan, 2003; Yue & Masi, 2003) have sought to assist faculty in addressing assessment shortcomings in technical areas accredited by the National Association of Industrial Technology (NAIT) and the Accreditation Board for Engineering and Technology (ABET).

In spite of these efforts, the experiences of the authors with two different accreditation agencies suggests that faculty and administrators at many institutions are still unclear about what constitutes an effective assessment plan, which in turn results in "weaknesses" or "partial compliance" with accreditation assessment standards.

This article is intended to describe an assessment model that has been effectively utilized in a technical department at a Midwestern university in Illinois (called MWU in this article) and thereby clarify the basic steps in the implementation of an assessment plan. Also presented are sample documents used for program assessment and a description of the process the department went through to evolve into its current assessment plan.

Moving Toward a Culture of Evidence

In 1998, the Illinois Board of Higher Education (IBHE) mandated that by 2004 each academic program within the state must be able to demonstrate a system for assessing student learning outcomes, and how those results were going to be used to improve programs (IBHE, 1999a). The mandate was phased in whereby each unit had to provide a list of learning outcomes by June 2001, a system of outcome measurement by June 2002, and then by June 2003 demonstrate how the assessment system led, or is leading to program improvements. An accompanying IBHE (1999b) document contained the following guidelines for implementing the Assessment of Student Learning and Improving Program Quality:

1. Assessment plans and quality processes should be faculty, program, and campus-driven.
2. Assessment plans and program approval and review processes should build on existing activities, i.e., integrate and expand on existing assessment activities.
3. Assessment activities should focus on the measurement and improvement of student learning outcomes, including multiple qualitative and quantitative assessments, as appropriate to the discipline.
4. Assessment of mastery and quality should not be a one-time event, but rather, a continuing process that monitors and self-regulates the educational enterprise to ensure that quality is continually enhanced.

Additionally, the IBHE recommended that all program assessments include the following six key elements:

1. A statement of program goals and intended student learning outcomes developed by each program's faculty that reflects uniqueness of that program.
2. Systematic (at different points throughout the program, including end-of-program evaluation) assessment of student learning that uses multiple qualitative and quantitative measures and reflects the uniqueness of academic programs and disciplines (e.g., evaluation of capstone experiences, internships, portfolios, performance on standardized, locally-developed, or professional licensure and certification exams).
3. Feedback gathered from key stakeholders—current students, alumni, and employers of graduates, graduate schools, etc., (e.g., surveys of student and alumni satisfaction; alumni job placement information; employer satisfaction).
4. Evidence of a formal and effective feedback/improvement mechanism, i.e., program faculty are engaged in a regular assessment and review process, and that the assessment of student learning and stakeholder feedback are used to improve curriculum, instruction, and learning.
5. Findings and recommendations for improvement are monitored by the institution for results at least yearly.
6. Assessment and improvement results are submitted to IBHE as part of an institution's normal schedule for reporting Program Review findings and recommendations, which are appended to the Institutional Results Report.

Although the IBHE guidelines and recommendations on outcome assessment were obviously state specific, the guiding principles and procedures were consistent with the accreditation standards used as a framework in the development of the department Assessment Program at MWU.

Resources were made available to assist departments with their assessment needs. Opportunities offered through the University Assessment Office and the Center for the Advancement of Teaching included mini-grants for supporting assessment projects, consultation and/or seminars, guest speakers or workshops on assessment, and travel support to conferences to build expertise in assessing student learning outcomes.

The recommendations of the IBHE correspond closely with assessment models that have been published since that time. Sarapin (2003) suggested a five phase model: Phase I - Review program goals and objectives, Phase II - Identify student outcomes, Phase III - Validate student outcomes, Phase IV - Administer assessment instruments, and Phase V - Revise program, revise courses, revise assessment methods. This assessment model was successfully used at the university level for two accreditation reviews. Strong et al. (2003) illustrated an eight step assessment model that was successfully implemented at two NAIT accredited institutions. The models reported by Sarapin (2003) and Strong et al. (2003) begin with the development of a mission statement for the program and then identifying the learning outcomes.

Step 1 – Develop mission statement. Lewis (1995) suggested that mission statements should answer three important questions: (a) What do you do? (b) For whom does your program do things? and (c) How do you go about doing them? The mission statement may also consider other factors such as location of the program and any special or unique features of the program (Strong et al., 2003). Faculty at MWU also developed and utilized the following principles to guide the development of institutional and departmental mission statements.

1. It should be brief for optimal usage. Other documents should spell out details.
2. It should be specific to the program, not something any and every university would say.
3. It should NOT include visions, goals, or aspirations, no matter how important these are to articulate. The mission statement is not the place.

4. It should not include qualifiers, clichés, definitions, or histories.
5. Broad and inclusive terms should be used.
6. It should be written in active voice.
7. It should have lasting significance and not be written for the short term.
8. It should not have a laundry or grocery list of items.

Using the aforementioned principles, the technical department faculty at MWU developed specific mission statements for each of its five programs. Input and consensus was also sought from program advisory committees.

Step 2 – Identify program goals and learning outcomes. Next the faculty began to identify program goals and learning outcomes. Sometimes course objectives are confused with program goals and outcomes. The number of course objectives can be much more extensive than the program goals and outcomes. Using the course objectives has the potential to become an unmanageable process. It is much better to focus on a smaller number of key goals and outcomes and keep the process simple to avoid failure (Strong et al., 2003). IBHE advised limiting the number of learning outcomes to six to ten per program. Further, learning outcomes and associated assessment should address, and be limited to, the enduring understandings of the program (Wiggins & McTighe, 1998). In other words, what are the essential knowledge, skills, and/or attitudes that the students in your program should know and be able to do by the time they graduate? In addition each outcome should establish the level or degree of performance expected (Weber State University, 2000). ABET (2003) provided a generic list of program outcomes that can serve as an example for those who are beginning to work on assessment outcomes for their programs. A few examples of ABET suggested program outcomes are:

An engineering technology program must demonstrate that graduates have:

a. an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines,
b. an ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology,
c. an ability to conduct, analyze and interpret experiments and apply experimental results to improve processes.

The mission statements and learning outcomes of the department or program should be carefully audited against those of the institution and college to assure consistency of purpose.

Step 3 – Compare learning outcomes to curriculum. In most programs, the majority of the curriculum likely predated the need for assessment planning. This was the case at MWU, although course development has historically been guided by program goals and approved by advisory committees. As such, the overall program learning outcomes were developed to correlate with existing coursework. If the program has several options for elective concentrations, for example a manufacturing program

Table 1. Cross Referencing Program Learning Outcomes to Course Content

	Manufacturing Courses					
Program Outcomes: Upon completion of the manufacturing program the student will be able to::	T111	T130	T216	T233	T240	T392
Interpret and apply basic concepts of materials science such as strength of materials, structural properties, conductivity, and mechanical properties.		K				
Analyze and apply basic electricity and electronic principles within the various manufacturing environments.	K, A				K, A, S	
Select appropriate manufacturing processes for product production applications such as forming, molding, separating, conditioning, joining, and finishing.		K, A		K, A		
Read and interpret manufacturing documentation such as blue prints, technical drawings and diagrams, production plans, tooling plans, quality plans, and safety plans.		K, A	K, A	K, A		K, A, S

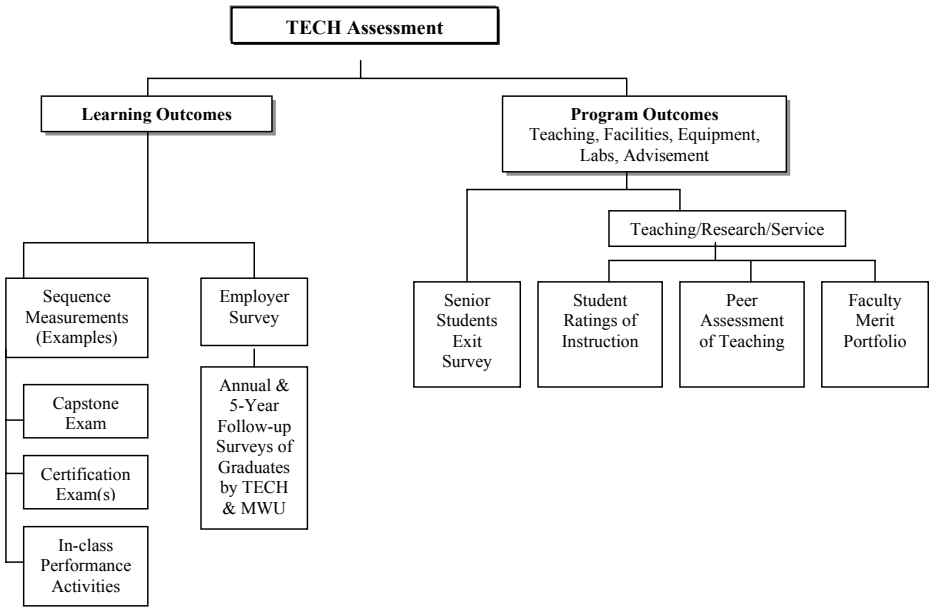
* Note: Each core course is 3 credit hours.
K –Knowledge - Student is required to pass written quiz or exam.
A – Application - Student is evaluated on the success and quality of a project, laboratory activity, written report of an experiment, etc.
S – Synthesis - Higher level achievement where a student is required to solve a new problem with little or no help from the instructor

my have specialty areas in plastics or product design, then learning outcomes should also address these areas.

Technical accreditation agencies such as NAIT and American Council for Construction Education (ACCE) either require, or strongly recommend, using an outcome-course matrix for this step. Table 1 is an example of such a matrix. In the left-hand column the program learning outcomes are listed. The courses that comprise the program are then placed in the adjacent columns. The matrix provides a good self analysis of which courses support each outcome. The matrix can be made more useful by coding the degree of content coverage or linking student performance to Bloom's taxonomy. For example, a lettering system could be utilized to indicate fundamental knowledge (K), application (A), or higher-order performance such as synthesis (S) (See examples matrix in table 1). The purpose of the matrix is to identify if the learning outcomes are adequately addressed in the program and to identify gaps or redundancy in the curriculum.

Step 4 – Measure program learning outcomes. Once the goals and outcomes have been established, a system must be in place to ascertain if the program outcomes are being met. Appropriate measures of student learning must be matched with the program outcomes. Both direct and indirect measures of student learning may be used. Direct measures consist of such things as written exams, oral exams, embedded questions in exams and assignments, portfolio analysis, papers/writing samples, simulated activities/case-studies, capstone projects, videotapes of student's skills, inside/outside examiners, and internship experiences. Indirect measures consist of exit interviews, participant observation, focus groups, satisfaction surveys, and reported job performance (Weber State University, 2000). There are advantages and disadvantages to using each of these measures of assessment. Nichols (1995) provides an analysis of using these different measures of assessment. Figure 1 displays the assessment measures, both direct and indirect, utilized at MWU for assessment of student learning outcomes and program outcomes.

Figure 1 Assessment Measures Utilized at MWU



At the specific technical program level, Table 2 graphically displays the assessment measures used by the technical programs at MWU and indicates who receives the assessment data. Outcome measurement is program specific and each program has the option of implementing the measurement tools they deem most effective to assess learning outcomes. Possible measurement tools may include: (a) comprehensive exit examination in the program capstone course, (b) student performance on appropriate certification examinations (NAIT, Society of Manufacturing Engineers (SME), American Institute of Constructors Level 1 examination, etc.), (c) examinations or performance activities in specific classes, and (d) results from department follow-up survey. Measurements selected should be benchmarked so that program and learning improvements can be tracked from year to year.

Three of the assessment measures outlined in Table 2 are department-wide measurements that gather data regarding teaching and program quality such as advisement and laboratory availability, as well as data about learning outcomes. These measurements are the (a) student rating of teaching, (b) department follow-up survey of graduates and employers, and (c) graduating senior exit survey,

Student rating of instruction is conducted using the Individual Development & Educational Assessment (IIDEA) system from Kansas State University. For consistency of measurement and standardization of the process of student rating of teaching between departments, the college began using the IDEA Student Rating for all courses in Fall 2002. (For information on IDEA student ratings see http://www.idea.ksu.edu/).

The graduate and employer follow-up survey is the second department-wide measure and has been conducted annually since 1990. The survey seeks data from both graduates and their employers as to how well program graduates were prepared for their first job and is structured to link responses directly to the stated program learning outcomes. The follow-up study is mailed annually in October to graduates from the previous academic year. For example, the fall 2004 follow-up survey sought information from fall 2003 and Spring

2004 graduates and employers.

The third department-wide measure utilized by all technical programs is an exit survey for graduating seniors (see table 3). The instrument was designed to replace the focus group interviews conducted since 1993 with quantitative data that can be shared with faculty in a timelier manner. In addition, numerical scores can be used as performance benchmarks. Data from the exit survey investigates "customer service" issues such as quality of instruction, advisement and placement services and not learning outcomes. Results from the follow-up survey and exit survey are presented in the department's Annual Report prepared each June and circulated to program coordinators for review by faculty and advisory committees for potential action.

Having the department conduct the surveys can provide a more neutral environment that allows constituents providing feedback a chance to express their opinion in an uninhibited fashion. In addition, certification exams are obviously administered and processed by third-party agencies. Direct measures of student performance in specific courses are the purview of instructors, who are responsible for compiling data and reporting annually to the program coordinator.

Step 5 – Compile and report the results. The results from all program assessment measures are channeled to the program coordinator who is responsible for preparing an Assessment Outcome Report by May 15 of each year for inclusion in the department's Annual Report. An annual assessment calendar with specific timelines and due dates has been created to guide the process of collecting and reporting data. As indicated on Table 2, the results are circulated to appropriate faculty and advisory committees for evaluation and potential action.

Step 6 – Evaluate assessment data and document program improvement actions. Up to this point the discussion has focused on "assessment," which is the measurement of performance or progress toward a goal (Frye, 2002). In this section we examine processes for "evaluation" or making decisions based on the assessment data (Palomba & Banta, 1999). Accreditation and assessment literature often refer to this process as "closing the loop." Table 4 provides an excerpt from an Excel worksheet used to collect the data for the Manufacturing Systems (MS) program for one year. The data is compared to the expected level of performance. The program outcomes being assessed are in the first column of the sheet. Next is a listing of relevant courses that are used to compare against the program outcomes. The following four columns are the results of the data collected for the assessment methods used. These data are compared to benchmarks which determine if an action or response is needed. Assessment results that fall below the established benchmark are color coded for ease of identification and potential action. The far right-hand column is an extremely important one because it shows the planned follow-up action and that the process provides a means of continuous improvement for the program. This is a part of the assessment process that is being scrutinized closely

Table 2. Methods and Reporting of Learning and Program Assessment Outcomes at MWU

Assessment Method	CM*	GC	CS	MS	TECH Dept	Reported To
Direct Measures of Learning Outcomes						
1. Course Exams		X	X	X		F
2. Certification Exams	X		X			AC, AR, F
3. Graded course work (e.g. presentations, work samples, etc.)		X	X			F
4. Program Exam	X			X		AC, F
Indirect Measures of Learning Outcomes						
5. Alumni Follow-Up	X			X	X	AC, AR, F
6. Employer Follow-Up	X			X	X	AC, AR, F
Measurement of Program & Teaching Quality						
7. Faculty T&P Merit Portfolio					X	T&P
8. Follow-Up Survey (Same as 5 & 6)					X	F, AR, FR
9. Student Ratings of Teaching					X	T&P
10. Peer Assessment of Teaching					X	T&P
11. Senior Exit Survey					X	AR, FR

*Abbreviations
Programs: CM = Construction Management, GC = Graphic Communications, CS = Computer Systems, MS = Manufacturing Systems.
Reporting: AC = Advisory Committees, AR = Annual Report, T&P = Tenure And Promotion Committee, FR = Faculty Retreat, and F = Program Faculty.

Table 3. Exit Survey of Graduating Seniors

Technical Department
Survey of Graduating Seniors

The purpose of this survey is to help faculty continuously improve TEC programs. Graduating seniors have gained many insights into the strengths of the program and areas where the program might be improved. Please answer questions 1 to 24 on the SCANTRON and written comments and employment information on this form. Thanks you for your assistance.

	Instructions: Please mark the appropriate bubble on the SCANTRON	1	2	3	4	0
1	Graduation Semester:	Spr / Sum	Fall			
2	Graduation Year	2004	2005	2006		
3	Degree Title	BS ITech	BS Tech. Ed			
4	Undergraduate Sequence	CM	GC	CS	MS	
	Instructions: For questions 6 – 24, please select the response that best captures your experience in TECH.	Strongly Agree	Agree	Disagree	Strongly Disagree	Does Not Apply
6	Faculty were helpful when I needed assistance.	1	2	3	4	0
7	Overall, the quality of instruction was excellent in TECH courses.	1	2	3	4	0
8	I was treated fairly in my dealings with faculty.	1	2	3	4	0
9	Faculty were experts in their subject matter areas.	1	2	3	4	0
10	The department's computer resources met my needs.	1	2	3	4	0
11	Overall, I was satisfied with the quality of laboratory equipment.	1	2	3	4	0
12	Lab hours provided access to equipment to complete assignments.	1	2	3	4	0
13	I was able to get into TECH courses in a timely manner.	1	2	3	4	0
14	I was satisfied with the help provided by the Academic Advisor(s)	1	2	3	4	0
15	An internship was a valuable part of my education.	1	2	3	4	0
16	Student organizations were a valuable part of my education.	1	2	3	4	0
17	I was treated equitably by other students.	1	2	3	4	0
18	Student Placement Office was helpful in my job search process.	1	2	3	4	0
19	TECH Career day was helpful in my job search process.	1	2	3	4	0
20	eRecruiting was effective in connecting with employers.	1	2	3	4	0
21	My career options have greatly expanded.	1	2	3	4	0
22	The content of TECH courses was state-of-the-art.	1	2	3	4	0
23	Overall, I learned a great deal in my TECH classes.	1	2	3	4	0
24	I would recommend TECH programs to a good friend or family member	1	2	3	4	0
25	Who or what influenced you in deciding to pursue the TECH program at MWU?					
26	Additional comments about your experiences with the TECH Dept at MWU?					
27	Optional Information ONLY used for Employer follow-up survey	Name:				
	Permanent email	:				
	Have you secured a permanent position in your field?	Yes	No	Tentative	Interview-ing	
	If yes to above, Name of Employer:					
	Address of Employer:					
	Thank you for your assistance!					

by accreditation agencies.

Table 5 presents a "Report of Program Improvements" form used by the coordinators and department administration as means to document and communicate changes in the program that resulted from the assessment process. The purpose of this document is to formalize the process and provide a record of verification to show that a response/action was taken to an identified weakness or concern. Identified areas that need improvement must be supported and validated by data. The completed form is submitted to the department for inclusion in the annual assessment report. As an alternative, Internet based software such as TracDat (http://www.nuventive.com/html/tracdat.htm) may be used to organize the assessment procedures, and compile, document, and report the results.

Step 7 - Communicate results to stakeholders. Although educational improvement is the primary goal, it is important to go beyond merely making instructional changes in response to program assessment data. A good assessment program will include communicating the results to its constituents and the public. Moreover, public communication is typically required by accreditation agencies. At MWU the

Table 4. Evaluation of Assessment Results and Proposed Method of Action

			Assessment Measure Results				
	Learning Outcome	Relevant Course #	Assessment Exam – Avg. by Category	MS Course Exams – Avg. by Category	Grad Follow-Up Items	Employer Feedback	Response/Action
1	Interpret and apply basic concepts of materials science such as strength of materials, structural properties, conductivity, and mechanical properties.	130, 285, 292	68%	78%	4.5	3.0	Competency will be discussed with MS faculty and Advisory Board. Alums believe they are well prepared. Employers typically have higher expectations of grad knowledge of methods that must be gained through actual work experience.
2	Analyze and apply basic electricity and electronic principles within the various manufacturing environments.	111, 240, 263	69%	85%	4.3	4.0	None at this time. Exam performance was very close to adequate. Alums and employers believe they are well prepared.
3	Read and interpret manufacturing documentation such as blue prints, technical drawings and diagrams, production plans, tooling plans, quality plans, and safety plans.	130, 233, 285	75%	78%	4.4	4.3	None.
4	Analyze and apply basic electricity and electronic principles within the various manufacturing environments.	116, 130, 216, 392	70%	82%	4.4	5.0	None.

Notes:
1. Benchmarks
MS Assessment Exam – Average score 78%
MS Course Exams – Students scored at least 70% in the topic category
Follow-up Survey of Graduates – Average ratings of >= 4.0 on 5.0-point scale indicates well prepared.
Follow-up Survey of Employers – Average ratings of >= 4.0 on 5.0-point scale indicates well prepared.
2. Areas of weakness, below established benchmarks, are color coded for ease of identification.

department's *Annual Report* is the first medium used to communicate the results of the outcomes assessment process. This report, which includes outcome assessment results from each technical program, is distributed to all department faculty, and key college and institutional administrators. The report presents the changes and improvements made and the rational for those changes based on assessment evidence. Next, the University Assessment Office receives a copy of each program's assessment report to save on the university website. This is an effective means of communicating to the public the continuous improvements that are being made. It helps to demonstrate the quality of the program and provides accountability. Assessment feedback is also shared with the program advisory committees to keep them aware of what is happening and obtain their recommendations. Additionally, the assessment information is provided to accrediting agencies as part of the self-study document in the re-accreditation site visit.

From an economical and political standpoint it makes good sense to show a method of continuous improvement as a result of assessment. Often times it can provide leverage in these times of tight budgets if the assessment process is done well.

Summary - Toward a Culture of Evidence

One of the keys to a good outcomes assessment process is convincing the faculty that it truly is an effective means of continuous improvement for their program and not just another requirement that has to be met for accreditation. While accountability is important, the literature shows that assessment should focus on improving learning. Assessment is part of doing business in institutions of higher education today. Our internal and external constituents expect this of us just as the companies that employ our graduates expect them to adopt a company philosophy of continuous improvement and quality.

The seven steps presented, and summarized below, are consistent with the literature and accreditation requirements, and should provide a solid foundation for effective program assessment.

Step 1 – Develop a mission statement.
Step 2 – Identify program goals and learning outcomes.
Step 3 – Compare learning outcomes to curriculum.
Step 4 – Measure program learning outcomes.
Step 5 – Compile and report the results.
Step 6 – Evaluate assessment data and document program improvement actions.
Step 7 - Communicate results to stakeholders

Further, the key to an effective outcomes assessment process is to focus on those enduring understandings that every graduate should know and practice. This avoids over assessing and complicating the process with excessive detail. Begin with the specific outcomes that your faculty, advisory committee, and/or professional organizations perceive as valuable and then seek their input with regard to evidence

Table 5. Example Form Used to Document and Track Program Improvement Actions

Program Improvement Report*	
Date of Report:	June 1, 200X
Program Name:	Graphic Communications
Learning Outcome Under Review:	#4. Students will be able to manage graphic production processes within the constraints of generally recognized and legislated safety codes and trade customs
Concern	Students are not displaying sufficient knowledge base in print production safety procedures and .printing trade customs.
As Evidenced By:	Only 25% of students obtained higher than an 80% grade on content specific to safety procedures in print production and the application of printing trade customs. *Benchmark is 70% will obtain a grade of > 80%.*
Action Taken:	1. T311 was revised to include content on/application of OSHA standards specific to print production. 2. Content changes will be made in T321beginning in Spring 200X based on revised printing trade customs by the Graphic Arts Technical Foundation and Printing Industries of America.
Follow-Up Review Method:	Assess T311 and T321 test grades in fall 2004.
Date of Next Review:	June 2005
Additional Comments:	A major curriculum revision is underway. This outcome concern will be revisited during the revision process in spring 2005.
Submitted by:	Dr. Sarah Ink

Note: Form presented in Table 5 adapted from assessment plan developed by Jack Landers at Central Missouri State University and used by permission.

that will accurately measure student performance. Keep in mind that the assessment system developed must have faculty support or chances of successful implementation are low.

It is equally important to remember that in these times of budget restraints resources are scarce. Consequently faculty are being asked to do more with less and need to balance the amount of time and resources devoted to this task with all the other demands of the job. An effective outcomes assessment process should include multiple measures of desired outcomes without overwhelming the faculty. A manageable outcomes assessment process is one that will maintain faculty support, provide useful feedback based on solid evidence, and allow for continuous improvement of the program to be made and communicated to interested constituents.

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