A Tool for Consolidating Results from Learning Assessment

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Abstract

We present a process for quantifying and organizing the degree to which course and program outcomes are achieved, using two Excel® spreadsheets. The first sheet shows outcomes established for a particular course and how their achievements are measured by several means. It also shows the "mapping" of the course outcome data into the achievement of outcomes that have been established for an entire program. The second spreadsheet consolidates the summary measures for all courses and shows how each course contributes to the fulfillment of the overall program outcomes. The result is an array of summary measures that can help identify the need to adjust an outcome or its method of assessment, or to modify course content or teaching methods. The intent is to provide a consistent format for all courses in a department or program while retaining flexibility and ease of use. After course outcomes have been established, most of the assessment data entry can be done by an office assistant rather than by the course instructor.

Introduction

Recently published works[1, 11, 12] consistently show that educators are taking a new view of assessment. Much of the motivation for this change comes from the realization that what matters is what students learn and can do after completing a program of study, not what the teacher knows or can do. This shift in understanding is reflected in the criteria that are now applied to schools by the various accreditation agencies[2, 3]. Increasingly, they look for evidence of assessment methods used to measure specific educational goals, rather than just to provide a grade for a course.

No single best method exists for learning assessment, but written evidence of a consistent and well-organized process is advantageous, if not essential, for ABET accreditation. The method presented here can be helpful in recording, comparing, and consolidating the results of various assessment means. While this method does not address the issue of assessment itself, it can simplify the necessary recordkeeping and provide consistency within an educational program.

Background

As our department began to prepare for a visit by a team of ABET evaluators, we discovered that the evaluation process had changed. Instead of counting square feet of laboratory space and looking at the age of our equipment, the emphasis had shifted to setting educational outcomes and measuring how well they were met. The assessment of outcomes had become a key issue. The results and analysis of those assessments were to guide us in revising course content and teaching methods wherever an opportunity for improvement became apparent. Course outcomes then could be refined, augmented, or even eliminated if appropriate. Thorough record keeping was necessary to facilitate this circular process of establishing outcomes, measuring their fulfillment, and making changes[2, 3, 4, 6].

Although the theory was sound, no one was quite sure how to document outcome achievement. Each faculty member knew the process was important and had been implementing some form of it in his or her own way. But no consistent method existed for formalizing course outcomes and assessing their values. Some faculty had trouble even with the terminology, asking, "What really is an outcome? Isn't it a goal, or maybe an objective?"

Responding to the persistent coaching of our department chair, we began to see the significance of the term. An outcome is a specification of an ability or skill you hope students gain as a result of taking your course. With that in mind, the process of assessment became clearer. If, for instance, we define as an outcome the ability of students to evaluate a frubulator (a fictitious device), then ways to measure that ability must be devised. We can make up homework problems and exam questions that deal with frubulators. At the end of the course, we can ask students how well they think they can evaluate frubulators. Moreover, we can ask ourselves as instructors how well we think they have gained that ability.

With everyone accepting that definition, we became comfortable writing outcomes for our courses. The outcomes then guide the content of exams. Since the intent of exam questions is more specific, they become a direct measure of outcome achievement. Further, the outcomes themselves become the basis for a survey that can be given to students at the end of the term. And, before looking at the students' responses, the course instructor answers the same survey, giving his or her own opinion of outcome fulfillment. Those responses show, for example, how well the instructor thinks the students can evaluate frubulators.

Another essential element was to show correlation between the outcomes that are specific to each course and those established for the entire program, in our case electrical engineering. The department had decided to adopt ABET's suggested set of program outcomes, commonly referred to as *(a)* through *(k)*. However, in response to surveys given earlier to recent graduates, the department added three more outcomes to the list. The additional curriculum outcomes specified competence in using laboratory equipment, in programming, and in using statistical methods.

The second step was to find a method for showing course outcome fulfillment in a quantitative way, based on our three major sources of data: exam results, student surveys, and instructor's perception. Although survey results are subjective in nature and exam scores are not an exact measure of outcome success, we still felt that using all three sources of data would allow a numerical rating of some validity. Moreover, we hoped for an indicator of success that would be simple to create and easy to interpret.

The method that met our needs arose from a suggestion made by our department chair. He proposed a simple Excel® spreadsheet with cells in the first column listing the outcomes for a given course. The cells in the first row of the next eleven columns would be labeled *(a)* through *(k)* for the program outcomes specified under ABET's Criterion 3, plus, in our case, the three more that we added for our program. Each instructor would place marks at the row and column intersections where a course outcome supported the fulfillment of a program outcome. More discussion and suggestions by other faculty members led to quantitative summary measures for each outcome based on the three methods of assessment for each course.

The realization that outcome assessment is an important part of the process of continuous improvement that ABET seeks[2, 3, 4, 6, 9] led recently to renewed interest in the spreadsheet tool and provided the incentive for further improvements. We refined the formulas, provided space for other methods of assessment, and added graphical presentations of the results. We also developed a second spreadsheet to consolidate the results for all courses on one sheet for the entire program.

While this method was designed as an aid to maintaining documentation for ABET accreditation, it could apply to any case where multiple assessment methods are compared and evaluated.

Examples from Recent Courses

The spreadsheet can be explained by the following example. Figure 1 shows data from the EE senior design course. The spreadsheet template provides for eight course outcomes on the left side of the sheet, but this course used only six. Moving to the right, the X marks identify the program outcome letters (*a* through *k* as given under ABET's Criterion 3, plus three more that this department added) that relate to each course outcome. Finally, the right side the sheet shows the achievement of each course outcome as assessed by three different means: a course evaluation survey given to students at the end of the semester, the instructor's own answers to the same survey, and students' graded work. These measures are given on a scale of 1 through 5.

For the first and second measures, the scale comes directly from our survey form, which asks students for their opinions about how well they have achieved each course outcome. The survey questions typically are stated as "I am able to …" followed by the outcome statement, where 1 represents "Strongly Disagree" and 5 represents "Strongly Agree."

In the case of students' graded work, the usual grade scale of zero through 100 is translated linearly to the scale of 1 through 5 to be consistent with the other two measures. The translation formula used is

$$y = 1 + x/25,$$

where x represents the average of students' grades for a group of tasks, and y represents the translated value. Ideally, each sample of graded work is designed to measure directly the achievement of a specific course outcome.

One faculty member suggested a different formula, since the one above translates a grade of 50, usually a failing grade, to 3 on the Likert scale of 1 through 5. Since the score of 3 represents a neutral response to a survey question, a better method might be to make a failing grade translate to a score of 1, with higher grades translated linearly. A grade of 100 would still

Course Outcomes for ELEC 420 - Spring 2004	Program Outcomes														Level of Achievement of Outcome (Scale of 1-5 for all data)				
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	Student Survey	Instructor's Perception	Graded Work		
Formulate the design specification	X				X										4.3	3.5			
Apply principles of teamwork in a cooperative design process				X											4.6	4.0	4.7	92.7	
Produce a design strategy for an open-ended problem	X		X		X		X		X	X					4.3	4.0			
Evaluate the feasibility of various approaches to problem solving	X				X										4.3	3.0			
Document the design process in well-organized written and oral presentations							X								4.5	4.5	4.5	88.3	
Construct and demonstrate a working device, system, or concept	X	X	X		X						X	X	X		4.5	4.5	4.7	92.1	
(Insert other outcome here)																			
(Insert other outcome here)																			
Total of occurrences	4	1	2	1	4	0	2	0	1	1	1	1	1	0					
Relative importance of program outcome in the entire course (0-3)	3	3	3	3	3	0	3	0	1	3	3	3	3	0					
Level of achievement of outcomes																			
Student perception - from course survey	4.4	4.5	4.4	4.6	4.4		4.4		4.3	4.3	4.5	4.5	4.5						
Instructor's perception	3.8	4.5	4.3	4.0	3.8		4.3		4.0	4.0	4.5	4.5	4.5						
As measured by exams, etc.	4.7	4.7	4.7	4.7	4.7		4.5				4.7	4.7	4.7		**Course Outcome Avgs.**				
Program Outcome Averages	4.3	4.6	4.5	4.4	4.3		4.4		4.2	4.2	4.6	4.6	4.6		4.4	3.9	4.6	91.1	

Program Outcomes Average 4.4

Figure 1: Course Outcomes/Program Outcomes for ELEC 420, Spring 2004

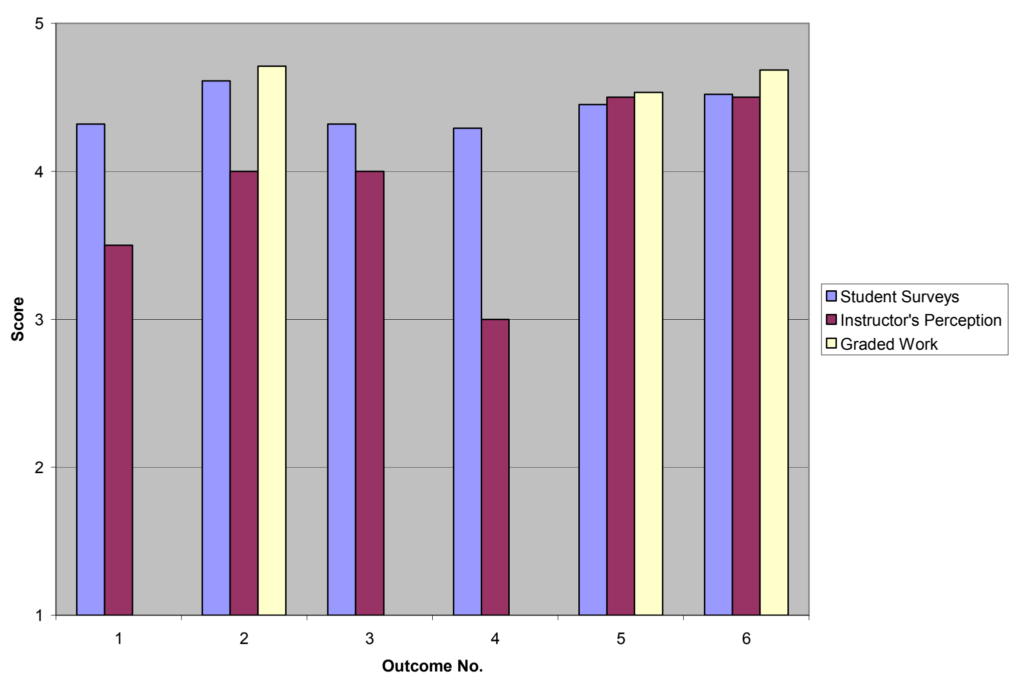

Figure 2: Histogram of Course Outcome Scores for ELEC 420

be equivalent to 5 on the Likert scale of opinion. For example, if a grade of 60 is set as the borderline between passing and failing, then the formula would be

$$y = 1 + (x - 60)/10, \qquad x => 60$$
$$y = 1 \qquad x < 60.$$

Other scaling methods could be implemented to suit the needs of different programs.

The numbers in the last few rows of the spreadsheet are composite averages based on the measurements for those course outcomes that apply to each program outcome. For example, if only the second and fifth course outcomes relate to program outcome *c*, then the figures at the bottom of that column are the averages of the scores for those two course outcomes, as assessed in each of the three different ways outlined above. The last row on the sheet shows the average of the three scores for each program outcome.

While this method of presentation is a combination of both direct and indirect measures, it serves at least two useful functions. First, it reveals any course outcome that receives a score significantly lower than the others, and that outcome can be re-examined.

Second, the data make evident any major disagreement between the three different sources of assessment. For example, students' evaluations of a particular course outcome might not be supported by their graded work. Similarly, the instructor's perception might differ significantly from those of the class. In either case, that outcome, or the means for measuring it, probably should be considered for revision. The histogram in Figure 2 compares the three measures for each outcome and makes such disagreements especially clear.

For the course that provided this example, students' perceptions of achievement for four of the six course outcomes are lower than that of the instructor. For Outcome 4, students' perceptions are also lower than the graded work indicates. Only two scores are less than 4, indicating that most outcomes were achieved reasonably well by any of the measures used.

Outcome 4, and to a lesser extent Outcome 1, show significant differences between students' perceptions and those of the instructor. One might suspect that either the wording of the outcomes was not clear or that the outcomes themselves may need revision.

Figure 3 shows data in the same format for another course, where eight outcomes were defined. The corresponding histogram in Figure 4 calls attention to Outcome 4, where graded work indicates considerably better fulfillment than the instructor's perception.

The summary measures for each course in a program can be linked to the second spreadsheet, which consolidates the assessment of outcome achievement scores for the entire program. Figure 5 shows this sheet with data from the two courses mentioned above as well as two others. This form computes average scores for each program outcome from all of the course assessments, according to each of the three measures (student surveys, instructor's opinion, and graded work) as well as in the aggregate. A single number reflects the average over all of these values. On a separate sheet, another histogram (see Figure 6) compares the scores for each program outcome,

Course Outcomes	Program Outcomes														Level of Achievement of Outcome (Scale of 1-5 for all data)				
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	Student Survey	Instructor's Perception	Graded Work		
Explain the meaning and significance of terms	X													X	4.1	4.0	4.3	83.5	
Use discrete random variables to compute probabilities and average values.	X										X			X	4.4	4.5	4.7	92.8	
Apply conditional probability analysis to develop decision rules and estimates.	X									X	X			X	4.2	4.0	4.1	76.3	
Analyze pairs of random variables in terms of their joint probabilities, covariance, and correlation coefficient.	X										X			X	3.9	3.5	4.3	82.7	
Compute probabilities associated with Gaussian random variables.	X	X									X			X	4.2	4.5	4.3	83.5	
Present solutions of probability problems to classmates.				X				X			X				4.2	4.5	4.3	82.3	
Use Matlab to simulate the performance of random systems described by probabilistic models.					X							X	X	X	4.4	4.5	4.3	83.5	
Develop least-squares estimates for parameters that appear in linear models.		X			X							X	X	X	4.4	4.5	4.5	88.0	
Total of occurrences	5	2	0	1	2	0	0	1	0	1	5	2	2	7					
Relative importance of program outcome in the entire course (0-3)	3	3	3	3	3	0	3	0	1	3	3	3	3	0					
Level of Achievement of Outcomes																			
Student perception - from course survey	4.1	4.3		4.2	4.4			4.2		4.2	4.2	4.4	4.4	4.2					
Instructor's perception	4.1	4.5		4.5				4.5		4.0	4.2			3.8					
As measured by exams, etc.	4.4	4.4		4.3	4.4			4.3		4.1	4.3	4.4	4.4	4.4	**Course Outcome Avgs.**				
Program Outcome Averages for This Course	4.2	4.4		4.3	4.4			4.3		4.1	4.2	4.4	4.4	4.1	4.2	4.3	4.4	84.1	
																		Program Outcomes Average	4.3

Figure 3: Course Outcomes/Program Outcomes for ELEC 471, Spring 2004

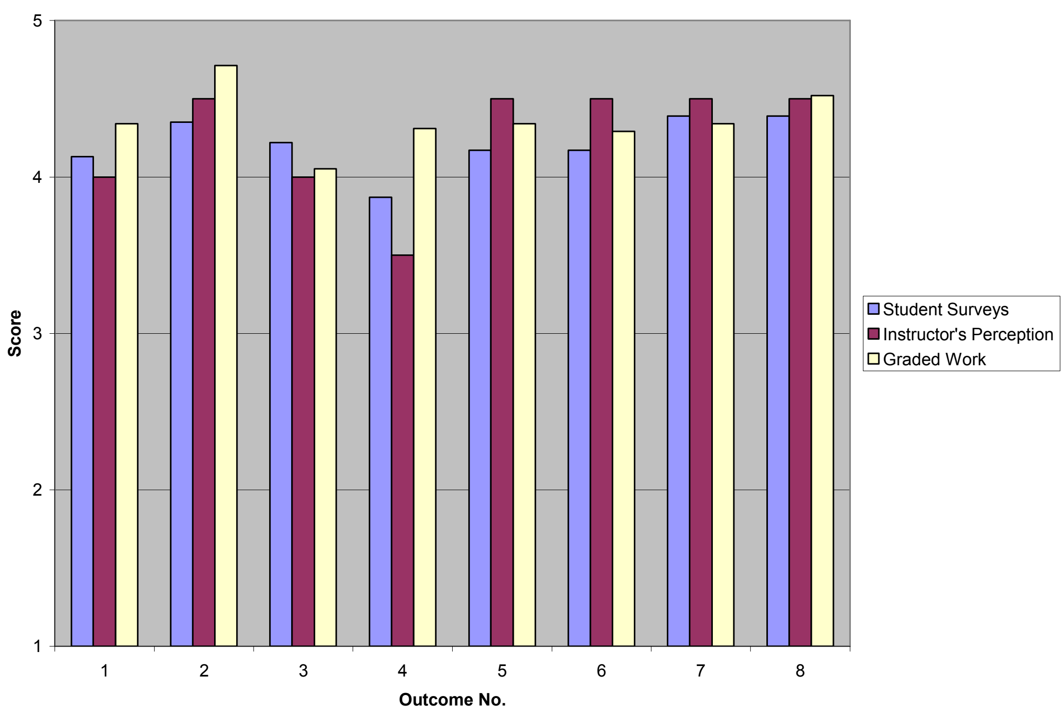

Figure 4: Histogram for Course Outcomes from ELEC 471

Course	Assessment Method	a	b	c	d	e	f	g	h	i	j	k	l	m	n	Course Outcome Averages (Scale of 1-5 for all data): Student Survey	Instructor's Perception	Graded Work
ELEC 120	Student Survey	4.5	4.5		4.5							4.4	4.6		4.6	4.51		
	Instructor's Perception	4.3	4.0		4.0							4.3	4.3		4.5		4.23	
	Graded Work	4.3	4.3		4.4							4.2	4.1		4.4			4.29
ELEC 225	Student Survey																	
	Instructor's Perception																	
	Graded Work																	
ELEC 226	Student Survey	4.0	3.9		3.9	3.9		4.0				3.8	3.7			3.88		
	Instructor's Perception	4.2	4.0		4.0	4.0		3.9				3.8	3.5				3.90	
	Graded Work	4.9																4.86
ELEC 350	Student Survey																	
	Instructor's Perception																	
	Graded Work																	
ELEC 351	Student Survey																	
	Instructor's Perception																	
	Graded Work																	
ELEC 400	Student Survey																	
	Instructor's Perception																	
	Graded Work																	
ELEC 420	Student Survey	4.3	4.6	4.5	4.4	4.3		4.4		4.2	4.2	4.6	4.6	4.6		4.40		
	Instructor's Perception	3.8	4.5	4.3	4.0	3.8		4.3		4.0	4.0	4.5	4.5	4.5			4.18	
	Graded Work	4.7	4.7	4.7	4.7	4.7		4.5				4.7	4.7	4.7				4.67
ELEC 471	Student Survey	4.2	4.3		4.2	4.4			4.2		4.2	4.2	4.4	4.4	3.6	4.21		
	Instructor's Perception	3.8	4.5		4.5				4.5		4.0	4.0			3.8		4.16	
	Graded Work	4.4	4.6		4.6	4.6			4.6		4.4	4.4	4.6	4.6	4.5			4.54
No. Occurrences		4	4	1	4	3	0	3	1	1	2	4	4	2	2			
Average Level of Outcome Achievement	From Course Surveys	4.2	4.3	4.5	4.2	4.2		4.2	4.2	4.2	4.2	4.2	4.3	4.5	4.1			
	From Instructors' Perceptions	4.0	4.3	4.3	4.1	3.9		4.1	4.5	4.0	4.0	4.1	4.1	4.5	4.2			
	From Graded Work	4.6	4.5	4.7	4.6	4.6		4.5	4.6		4.4	4.5	4.5	4.6	4.4			
Program Outcome Averages		4.3	4.3	4.5	4.3	4.2		4.2	4.4	4.1	4.2	4.3	4.3	4.6	4.2	4.25	4.12	4.59

Average of All Program Outcomes 4.29

Figure 5: Consolidated Assessment Scores for EE Program, Spring 2004

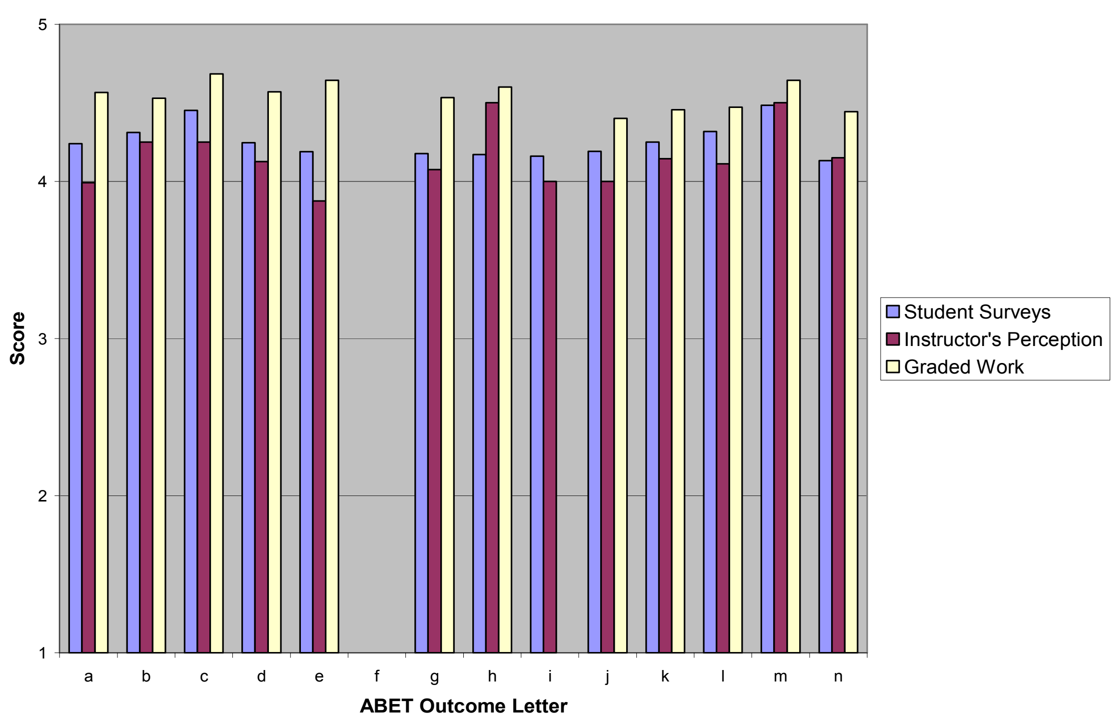

Figure 6: Histogram of Program Outcomes from Figure 5

measured in the three ways. (While the chart shows the scores according to students' graded work to be consistently higher than the other two measures, this bears little meaning since some of the grades were generated artificially to produce this example.)

Applying the Form to Other Courses and Programs

While the spreadsheet appears to contain a large number of entries, those in the shaded areas are computed automatically by Excel formulas. The raw assessment data that is needed will be readily available after grades are submitted at the end of a semester. The remaining items can, and preferably should, be determined before the course begins.

The steps for completing the course outcome sheet are as follows:

1. Establish the desired course outcomes. They should become a part of the course documentation and shared with students. They are entered as text into Column A of the spreadsheet, starting at Row 5. While the template was designed for eight outcomes, additional rows can be inserted to allow for more.

2. Decide which program outcomes (or PEO's) are supported by each course outcome. Place an X on the sheet at each intersection of those corresponding course and program outcomes. For example, if the first listed course outcome supports ABET items (a) and (e), place X's on that row under Program Outcomes (a) and (e).

3. Decide on the relative emphasis given to each program outcome in this particular course, on a scale of zero to 3. Enter those numbers in Row 15 for each program outcome. (In the present examples, these figures do not affect the computations.)

4. To the extent possible, develop graded assignments and exam questions that specifically address each course outcome. Maintain a record of the scores for these assignments and questions, and compute a class average for each. This is an important step, because ABET considers it to be a direct measurement, as opposed to one based on opinion, such as a survey.

5. The course outcomes determined in Step 1 become the basis for the survey given to students at the end of the course. In our case, the completed survey forms are processed by Bucknell's Information Services and Resources department and returned along with statistical summary measures for each question. The averages of the responses to each question are entered in Column P, under Student Survey.

6. Before looking at the student survey results, the instructor(s) should complete the same survey form, indicating his/her opinion of the extent to which each course outcome has been achieved by the students, and enter the data in Column Q. If different sections of the same course were taught concurrently by two or more faculty, either their individual responses to the survey form could be averaged and transferred to the spreadsheet, or each instructor's class could be assessed separately.

7. Enter the averages of graded work, on a scale of zero to 100, in Column S, for each course outcome to which a grade average applies. If more than one grade average applies to a particular course outcome, a weighted or unweighted average of those scores can be used as the measure. If the instructor decides on a weighted average, it is essential to maintain a record of the weighting and its rationale.

The spreadsheet will compute a set of achievement scores, on a scale of 1 to 5, for each program outcome, each course outcome, and each assessment method. On a separate sheet, Excel also will create a histogram showing the average scores for each course outcome according to the three assessment methods. This graphic clearly reveals outcomes that receive relatively low scores as well as disagreements between assessment methods.

The summary measures from the spreadsheets for all courses can be copied automatically or manually to the second spreadsheet, which computes average scores for each program outcome, again according to the three assessment methods. Another histogram shows these average scores graphically.

Using the Results

The intent of these assessment forms is to reveal more clearly the course outcomes and program outcomes that have been achieved and those that may need attention, by presenting all of the information quantitatively on one sheet. The graphical presentations provide the same information in an even more concise way. However, keep in mind that the assessment of outcome achievement is only one step in the continuing process of program improvement.

Summary

We have presented a process for quantifying and organizing assessment data show the level that course and program outcomes are achieved. The process provides a consistent format for all courses in a department or program while retaining flexibility and ease of use. To encourage use of assessment data, we designed the spreadsheets to allow an office assistant to enter most of the data while providing valuable feedback to both the instructor and the department or program.

In the interest of simplicity, this process uses only averages to summarize the assessment results. An extension of the process could add other summary measures, such as the standard deviation or the distribution of students' accomplishment of a given outcome, to provide a more complete picture of outcome fulfillment.

Acknowledgements

The authors appreciate the cooperation, interest and suggestions made by the faculty and staff of the Electrical Engineering Department at Bucknell University.

References

1. "The Contributions of the Research University to Assessment and Innovation in Undergraduate Education," Kuh, George D., in *The Scholarship of Teaching and Learning in Higher Education: Contributions of Research Universities*, Becker, William E. and Moya L. Andrews, eds., Indiana Univ. Press, 2004

   While apparently written in defense of research universities, this chapter refers to numerous authors and emphasizes the growing trend toward viewing assessment as more than just grading students' work. Criteria based on performance and evidence of learning must be defined in advance, and methods of assessment must be designed to measure the achievement of those criteria. Promotes the idea of assessment itself as a form of scholarship.

2. "Criteria for Accrediting Engineering Programs," ABET Engineering Accreditation Commission, Nov.1, 2003

   Changes approved by ABET as of Nov. 1, 2003 for 2004-2005 accreditation cycle. For Criterion 2, PEO's apply to graduates several years after graduation. Objectives must be based on constituents' needs and periodically evaluated. Documented procedures must be in place to assess achievement of these objectives and use results for improvement.

   For Criterion 3, outcomes (a) through (k) apply to the program rather than individual courses and may be augmented to suit a particular program. Each program must have an assessment process with documented results that are applied to program improvement. Assessment process must show that outcomes are measured.

   Further changes have been proposed that would place more stress on assessment of outcome achievement by direct measurement and documentation of evidence showing that results are applied to program improvement.

   Proposed changes also would expand outcome (c) to include realistic design constraints, and (h) would add economic and environmental to global and societal context.

3. "Guidelines to Institutions, Team Chairs and Program Evaluators on Interpreting and Meeting the Standards Set Forth in Criterion 3 of the Engineering Accreditation Criteria"

   (This brief document was downloaded from the ABET web site. It bears the date 5/13/2004 but no author is identified.)

   Attempts to clarify the requirements of Criterion 3, with limited success. Emphasizes assessment with documented results showing that students have achieved each of (a) through (k) by the time they graduate. Evidence of achievement must be "convincing," but sampling may be used. That is, not every student's achievement need be measured every year. Moreover, not every outcome needs to be assessed every year. However, a

scheduled process must be in place and results must be documented and used for program improvement. A process coordinator is suggested.

Further, student surveys are considered indirect measures and not by themselves reliable evidence. Emphasis is on “performance indicators” that can be measured directly, through student portfolios, subject content exams, and performance evaluations. Faculty judgment appears to be a key measure, as opposed to student opinion. But grades alone are not measures of outcome achievement. Good documentation is very important.

4. “EC 2000 From Both Sides of the Fence,” LeBlanc, S. E., Session 2513, Proc. 2002 ASEE Annual Conference

   Looks at EC2000 both from the viewpoint of an ABET evaluator and a department chair. Emphasizes the importance of adequate recordkeeping. PEO’s must be formulated in consultation with constituencies. “… a paper trail is crucial to documenting the process.” All faculty in a department must understand and support the process. Likes the idea of assignments and exam questions that address particular outcomes as evidence of learning. Concludes that “… effective faculty involvement and proper documentation are essential …” One of the better papers.

5. “Assessment of Engineering Attributes for ABET Accreditation,” Koehn, E., Session 3421, Proc. 2002 ASEE Annual Conference

   Makes the point that not all of (a) through (k) are equal. Graduating seniors in civil engineering and practitioners both agreed that (a) and (e) were the most important, while (h) and (j) were least important. Suggests that engineering programs need not place the same emphasis on all of the eleven outcomes in their curricula.

6. “EC 2000 Round Two – The Arkansas Experience,” Elliott, Robert P., Session 2515, Proc. 2002 ASEE Annual Conference

   Provides a historical review of ABET evaluation under both the “old” and the “new” systems. Mentions a number of assessment methods. Strongly emphasizes the need for “closing the loop” and maintaining documentation to show that it was done. Also states that assessment, recordkeeping, and improvement where needed must be a continuous process. Concludes with a comprehensive list of recommendations. A good paper.

7. “Electrical Engineering Arizona State University ABET Accreditation Visit Nov. 2^{nd}-4^{th}, 2003,” PowerPoint Presentation at ECEDHA Annual Meeting, Orlando, FL, March 19-23, 2004

   Shows how their whole process developed over a period of several years. Ends with good comments from their ABET review.

8. "Breakout II – ABET Update," Soldan, David L., PowerPoint Presentation at ECEDHA Annual Meeting, Orlando, FL, March 19-23, 2004

Outlines main points in "Guidelines …" (Ref. 2)

9. "IEEE, CEAA, ABET, Continuous Improvement," Orr, John A., PowerPoint Presentation at ECEDHA Annual Meeting, Orlando, FL, March 19-23, 2004

Explains the role of IEEE Committee on Engineering Accreditation Activities (CEAA) in supporting ABET evaluators.

10. "Defining the Outcomes: A Framework for EC-2000," Besterfield-Sacre, Mary, *et. al.*, IEEE Trans. on Education, v. 43, No. 2, May 2000, pp. 100-110

A comprehensive and often quoted paper on developing measurable outcomes that comply with EC-2000, based on Bloom's taxonomy and McBeath's action verbs. Refers to an extensive list of terms and phrases for use in formulating outcome statements. (These documents were given to the EE faculty in preparing for our 2002 ABET visit.)

11. "A Critical Review of Student Assessment Options," Prus, Joseph and Reid Johnson, Winthrop Univ., Rock Hill, SC, 1994

Lists 14 methods of student assessment and gives advantages, disadvantages, and ways to reduce disadvantages for each method. Makes several good points:

a. There is no perfect, "one fits all" method for learning assessment. All have advantages and disadvantages.
b. Search for the ideal, but realize that a best fit is all you can get.
c. Don't rely on any single method; use several to reduce the unavoidable errors.
d. Assessment methods themselves should be the subject of assessment.