2006-1500: MEASUREMENT AND EVALUATION IN ENGINEERING TECHNOLOGY

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Measurement and Evaluation in Engineering Technology: M.E.E.T.

Abstract

Preparation for compliance with TC2K for ABET accreditation is being carried out at twelve geographically-dispersed campuses which offer one or more of nine different engineering technology programs. An online system has been developed to aid in the collection of assessment data. This system makes use of embedded assessment measures and involves faculty at all levels in the ABET process. The system includes a suite of instruments measuring student performance, faculty perception, and student perception of performance vis-à-vis the program outcomes. This paper will describe the system in its current state and provide examples of data collected to date.

Background

As all engineering technology educators are now aware, the Accreditation Board for Engineering and Technology (ABET) has changed its requirements for program accreditation. Where they once focused on facilities and inputs, the criteria are now learner-centered and performance-based.[1] Each engineering and engineering technology program is required to develop learning outcomes and demonstrate student achievement through the assessment of student performance on these outcomes. The engineering technology programs at the large land-grant university system that is the focus of this paper are geographically dispersed throughout the state, making it difficult for faculty teaching the same courses to coordinate their efforts, to work together to develop program and course outcomes, and to coordinate the collection of assessment data.

Description of Solution

An assessment team made up of the department head, the director of Engineering Instructional Services, and a graduate research assistant worked with a representative group of faculty to develop an online system that standardizes data collection across the distributed campuses. Each of the nine programs developed specific, measurable outcomes and mapped them to appropriate courses. The assessment team built a database to maintain the outcomes and related data.

The final design incorporates six survey and survey-like instruments for data collection. Rather than seek questions and statements that serve as proxies for the program and course outcomes, all of these instruments deal directly with the outcomes themselves.[2] In the following section, the three primary instruments that form the M.E.E.T. ("Measurement and Evaluation in Engineering Technology") system will be described.

1. Student Performance. Faculty are presented with a list of their students, along with a list of the course-level outcomes associated with their course(s). They are asked to rate each student's ability to perform each outcome using a 3-point scale ("Exceeded", "Met", "Not Met"). They are then asked to specify the evidence used to make this judgment, i.e. specific homework problem or specific lab

project. (Figure 1.) The evidence section is most critical to effective assessment, as it controls against a "Lake Woebegone" effect in which all of the students are seen as "above average". Faculty are required to provide justification for their ratings.

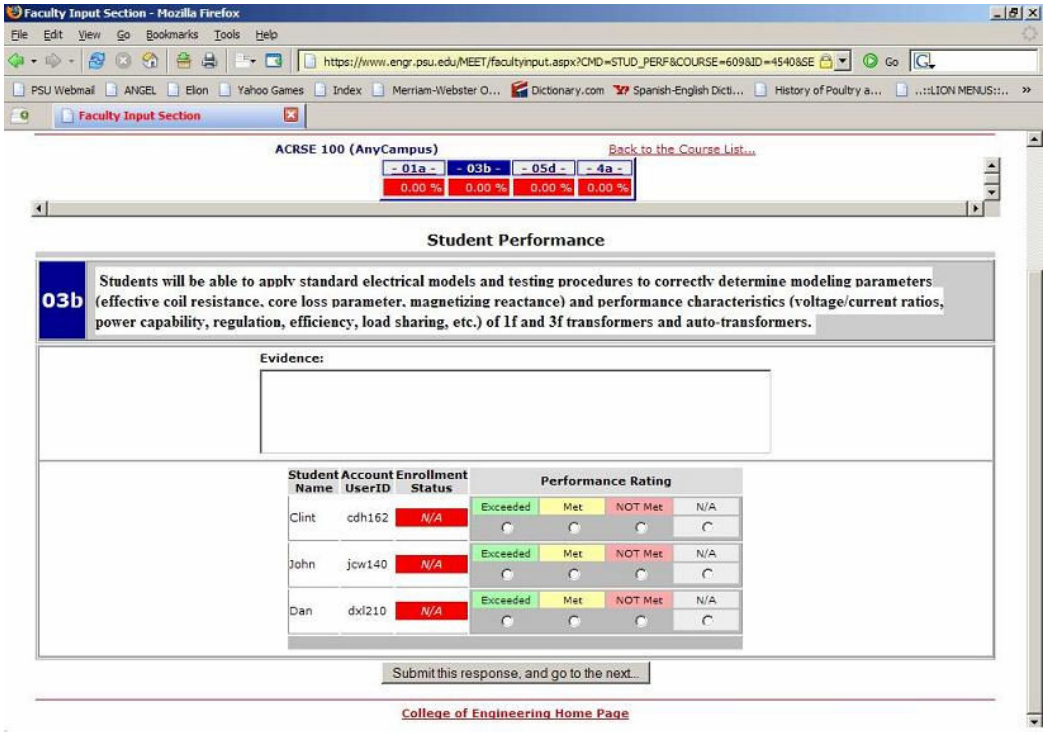

Figure 1. Faculty Assessment of Student Performance

2. Faculty Perception. Faculty are presented with a list of the course-level outcomes for their course, and asked to rate the overall effectiveness of the course in helping the students to meet the outcomes. They are given the opportunity to reflect on successes and shortcomings, identify equipment needs and constraints, and otherwise record their assessment of the course. This data is available to all other faculty, and may be used as formative feedback for course improvement. As with the student performance, a three-point scale is used, reflecting the levels of effectiveness: Very Effective, Effective, and Not Effective. Use of this instrument promotes the type of reflective practice desired in faculty while also providing data for ABET accreditation. Faculty are aware that their comments are viewable by the peers and that they will be considered by administrators. This can have an empowering effect, which will be tested in future research on this system.

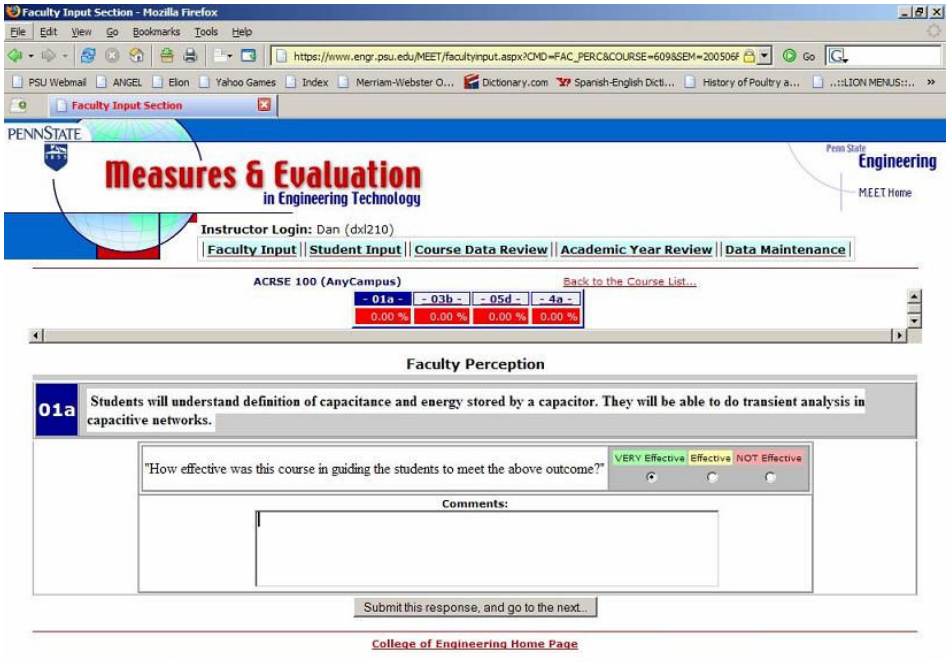

Figure 2. Faculty Perception of Course Effectiveness

3. Student Perceptions. Students are presented with the same list of course-level outcomes, and are asked to rate their own ability to do each of them. They are also asked to indicate how much the course contributed to their ability.

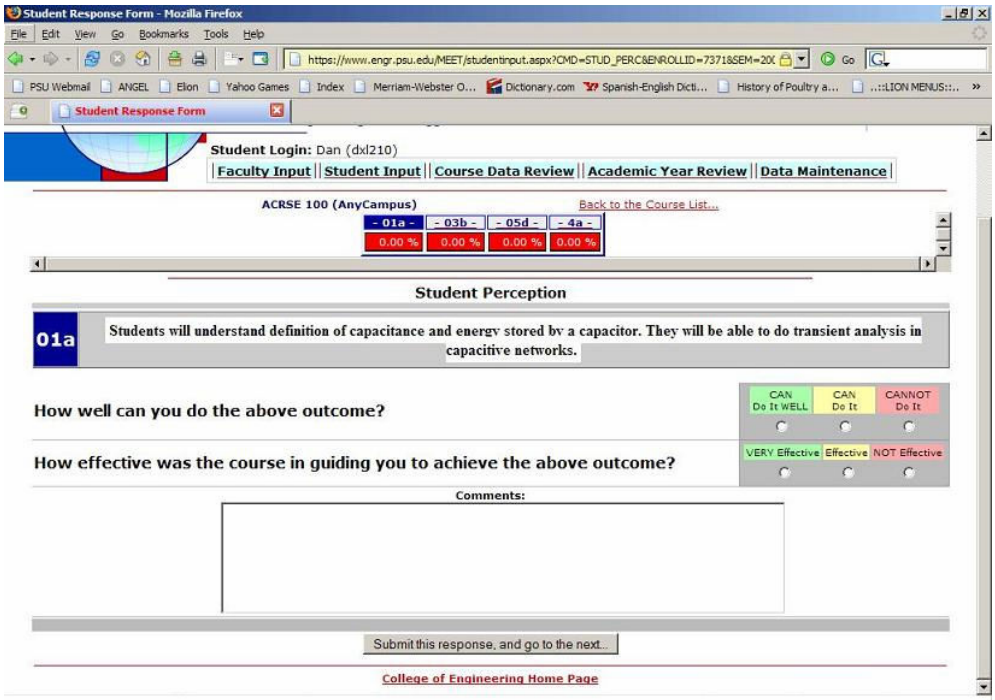

Figure 3. Student Perceptions

It is possible for a student to have a high degree of ability to perform an outcome without the course being the source of this training. If this is true for a large number of students, the content of the course may be modified to spend less class time on this particular topic. The students' rating of their ability to perform a certain course outcome is compared directly to the instructor's assessment. Discrepancies between these two marks will be discussed below.

The M.E.E.T. system provides data review tools that make it easy for administrators and other interested people to make comparisons between campuses, courses, and academic years. Data can be reviewed in "real time", as it is entered by users. (Figure 4.)

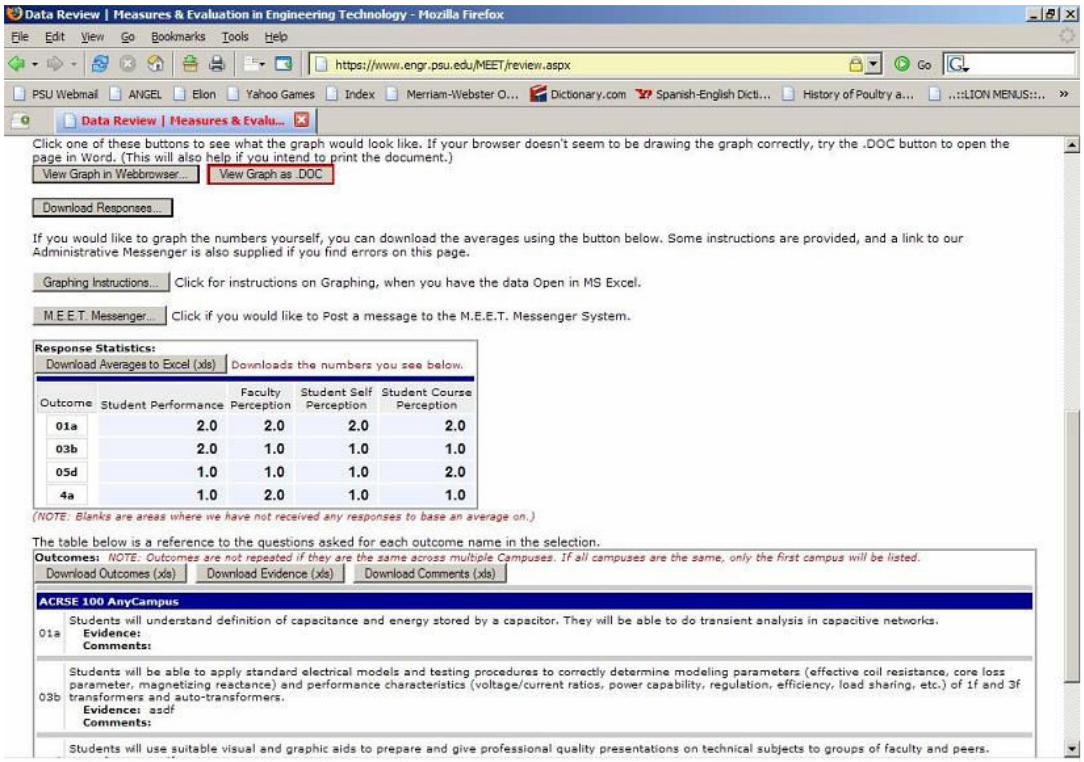

Figure 4. Course Data Review Screen

Supplemental to the primary M.E.E.T. instruments are three additional online surveys that address program outcomes and program educational objectives. Note that the M.E.E.T. deals primarily with the "measurable" course-level outcomes.

1. Exit (Graduation) Survey. This survey is available online, and potential graduates are presented with the list of *program outcomes* and asked to reflect on their abilities in each of these areas.

2. Alumni Survey. This survey assesses the efficacy of the *Program Educational Objectives* by presenting alumni with a list of the PEOs and asking them to identify which ones are representative of the types of things that they are

accomplishing 2-3 years after graduation. This data may be used for assessing the attainment of the PEOs as well as feedback on their efficacy.

3. Industry Survey. The industry survey is a means for assessing the Program Educational Objectives and the Program Outcomes. Employers and potential employers are asked to rate a graduate's performance against the list of program outcomes. Both employers and potential employers then provide a review of the program educational objectives.

Results

The system was subjected to extensive pilot testing in the Fall 2004 semester, and was fully implemented in the spring of 2005. As expected, the system readily identified inconsistencies between student and instructor assessments. The following are typical findings and interpretations:

- Faculty reports that no students are capable of meeting a course objective
    - In this case, the faculty are often not aware that an ABET outcome has been assigned to their course. Thus, a simple lack of communication can be simply rectified.
    - A glance at instructor comments may reveal that a certain software needed to meet this outcome was not available. The outcome can be modified, or the software obtained.
    - An assessment expected to take place in this course is not happening. The instructor involved may use M.E.E.T. to review offerings at other campuses and see what types of assessment are being used by colleagues.

- Students report that they are NOT able to perform an outcome, while the faculty reports that they EXCEED EXPECTATIONS
    - The wording of the outcome may be such that the students do not recognize that they have in fact learned to do the task.
    - The evidence provided by the faculty may be reviewed to insure that it is an accurate measure of the outcome as intended.

Conclusion

The system described in this paper is designed specifically for higher education, where faculty have great latitude in the design and delivery of their courses. Although ABET accreditation requires a program-wide system of assessment, there is no need to impose external measures on faculty that will be resisted. This system recognizes *existing measures* in use by the faculty and *uses these measures* to support the program's continuous quality improvement plan. It is thought that this approach respects the authority and professionalism of the faculty, which may increase faculty involvement and understanding of the ABET process. The system is *scalable*, allowing for data to be collected for all students in all classes for all semesters, or only one class per semester as needed. The system does not provide specific recommendations for improvement. It is

meant to "flag" potential problems regarding student performance and assessment, bring them to the attention of the program, and make it possible to manage program assessment activity in a large educational system.

Finally, the system encourages cross-talk among faculty and embeds the language of outcome-based assessment into the regular reports collected from faculty. This increases faculty buy-in and helps encourage the attitude that assessment is truly for program improvement and not merely for accreditation.[3]

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