

Guest Editorial

ASSESSMENT FOR CONTINUOUS IMPROVEMENT: WHAT HAVE WE LEARNED?

‘For every complex question, there is a simple answer . . . and it’s wrong.’ H. L. Mencken may well have been thinking about accreditation and the assessment and evaluation process when he penned these words. Although we look for a simple model, there is no one right way to assess engineering programs. In fact, there is no common agreement as to the scope of the processes that should be used in accreditation and assessment. This was evidenced at an international meeting held by the United Engineering Foundation in Italy to discuss issues surrounding the accreditation and assessment of engineering programs [1]. Presenters from 18 countries shared the current trends in accreditation and assessment in engineering in their countries. There did not seem to be consistent assessment processes nor foci among the programs. However, in every case, the need to emphasize outcomes assessment of engineering programs was the result of external pressures for accountability. In some instances, accreditation was optional but in all instances, the need to assess the outcomes of engineering education programs was driven by a state, regional or national requirement. This is not to imply that prior to external mandates there were no assessments of engineering programs. However, external accountability has created a move from informal to formal processes of assessment and evaluation of engineering curricula where programs must be explicit about their intended outcomes, develop assessment processes to measure the outcomes, and evaluation processes to determine what improvements, if any, need to be made.

Assessment of engineering programs should be approached as a structured, open-ended design problem. The design problem is structured because assessment does not start with a blank slate. The curriculum and delivery processes are already in place. It is open-ended because there is no one right approach to assessing engineering programs for continuous improvement. The engineering design process includes needs analysis, recognition of constraints, application of models to problem solutions, evaluation of alternative solutions, development of prototype, testing, implementation of improvements, production, client/customer feedback, implementation of improvements, etc. Engineering faculty are well equipped to apply these design process skills to the design and development of the engineering curriculum and the application of assessment practices to test the efficacy of their curricular design.

In this special issue of the International Journal of Engineering Education, the design and implementation of the assessment processes to support the continuous improvement of engineering programs is broadly covered. Many of the articles focus on the accreditation requirements of ABET which is the accreditation agency for engineering programs in the United States. However, the articles were chosen for this issue because of their overall contribution to the understanding of how assessment processes can be used in the design, development, assessment, evaluation, and improvement of engineering curricula.

The first article discusses the benefits of involving employers in the analysis of program needs and evaluation of outputs (Liangrokapart *et al.*). The benefits of the use of appropriate focus group protocols to maximize the effectiveness of employer input are illustrated. Recognizing that each engineering program has constraints that are particular to the local situation, the second article presents a discussion of the fact that knowing ‘how to do’ assessment is necessary, but not sufficient to be effective (Hoey and Nault). This article makes a compelling case that the assessment process needs to be built on a foundation of trust between faculty and administrators in order for the results of the process to be credible. The authors describe the characteristics of trust at multiple levels.

Several models are described in this issue that can assist faculty in the development of a framework for the assessment process. The first discusses how empirical methods were used to develop a model of the engineering education system (Besterfied-Sacre *et al.*). The authors discuss how the model can be used to understand the relationship between educational processes and outcomes. Another article describes how value engineering techniques can be used to support the curriculum review process (Gershenson *et al.*). One of the techniques used is Quality Function Deployment (QFD) which is also the focus of an industrial analogy used by another author to describe how QFD can be used to understand the context for assessment of engineering programs (Brackin).

There are four articles that address different approaches to assessment. The first article takes a comprehensive look at research-based assessment methodologies (McGorty *et al.*). This reports on a multi-institutional project that looked at twelve different assessment methods and their application to engineering education. Another article addresses the use of multiple authentic assessment methods in a multi-disciplinary industry project to evaluate student learning (Wellington *et al.*). The importance of the use of multiple methods in assessment is illustrated in the evaluation of course effectiveness and the assessment of student learning in an international freshman research and design experience (Adams *et al.*).

Two additional articles discuss the application of specific assessment methods. One describes the experience of designing and using rubrics within capstone courses as a valuable source of assessment data (Shaeiwitz) and the other the use of portfolios (Williams).

In the United States, many institutions have already been reaccredited under the new outcomes assessment standards of ABET's Engineering Criteria 2000 (EC2000). Three different institutions describe the assessment processes they used to meet the EC2000 requirements (Briedis; Miller and Olds; Terry *et al.*). These assessment processes are useful examples of the different applications of assessment to engineering programs.

One of the issues that faculty often struggle with is how to make sense of all the data that are collected. This topic is critical for engineering programs to be able to make informed decisions about the curriculum and 'close the loop' on the continuous improvement process. An example of how one institution approaches this problem is described in the use of decision support software and statistical analysis (Deniz and Ersan).

To support the success of engineering programs in their efforts to develop continuous improvement processes, ABET developed and implemented a series of regional faculty workshops which have been held around the United States. These workshops have been supported by the National Science Foundation and sponsored by industry. The methodology and results of these workshops are presented in an article that provides insight into the faculty and institutional experience (Weiss and Aldridge).

The compilation of the articles in this special issue are designed to provide the reader with both a breadth of articles around the various aspects of the assessment process and an in-depth understanding of what the process entails. The success of this effort will be measured by the ability of the reader to apply some of the insights provided in their own setting.

REFERENCE

1. 'Engineering Education for Global Practice in the 21st Century—Accreditation and Assessment'. Castelvechio Pascoli, Italy, April 9–14, 2000. Sponsored by the United Engineering Foundation, New York, NY.

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