Engineering Accreditation: Assessing and Documenting Students Competencies in their Respected Disciplines

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Abstract

In general, the accreditation is a process intended to ensure that degree programs in engineering fields are consistent with regards to quality standards and requirements set by their respective professional organizations. Initialed in 1932, as the Engineers' Council for Professional Development (ECPD) and then in 1980 renamed as the Accreditation Board for Engineering and Technology (ABET), Inc. is a coalition of over thirty five professional societies and organizations with over two thousands volunteers conducting program reviews. Over the past two decades, many academic institutions outside the United States had prepared and have gone through the accreditation process and more are joining annually.

This paper presents the process and its challenges as well as the experience gained by an American university branch campus in in the Middle East. The paper also presents the benefits of accreditation in attracting more academic well-trained students to engineering programs.

Keywords
Accreditation; ABET; Assessment; Continuous Improvement; Engineering Curriculum

1. Introduction
For graduating United States engineers to become licensed professional engineers in their state of employment, a degree from accredited engineering programs is essential. The registration offices for professional engineers and land surveyors are often the state arm for granting license to practice engineering as professional engineers. With no exceptions, an engineering and in some limited instances a technology degree from an accredited program are required for applicants interested in taking the first segment of this exam, Fundamental of Engineering. Hence seeking accreditation for engineering and technology programs is considered essential for existence of such programs. ABET accredits university programs in engineering, engineering technology, computing, and applied and natural science

through its four Accreditation Commissions. Each commission regularly reviews its criteria and procedures and makes appropriate adjustments as needed. Although preparing an engineering program for accreditation has been mapped very clearly by ABET, the preparation of self-study, course materials, and above all training the program faculty and staff to fully understand and appreciate the roadmap to a successful and sustainable ABET visit demands attention and discipline.

2. Accreditation Criteria

Engineering Accreditation Commission currently requires that every engineering program meets eight criteria developed by ABET for engineering disciplines. These include students, program educational objectives, student outcomes, continuous improvement, curriculum, faculty, facility, and institutional support. In addition, each program must meet the required program criteria. Although all eight criteria are equally important, more attention is normally devoted to criteria two, four and five.

Criterion 2, Program Educational Objectives, is defined as "board statements that describe what graduates are expected to attain within a few years after graduation." Program Educational Objectives (PEOs) are required to be aligned with the institution's mission and needs of the program constituencies. Programs are required to develop and systematically utilize a documented process which allows PEOs to be periodically reviewed and revised as needed per needs of the program constituencies and the institution's mission. Some of the challenges with this criterion include that PEOs are not consistent with the definition of the "broad statements of what graduates are expected to attain" or all constituencies' needs are not sought and incorporated.

Criterion 4, Continuous Improvement, requires that "the program systematically uses appropriate documented processes to assess and evaluate the extent to which the Student Outcomes (a-k in the Criterion 3) are being attained." This criterion also requires that results of these evaluations be utilized for the improvement of the program. Assessments in general could be a combination of both direct and indirect methods, however, they have to be appropriate and show what has been measured and how the objectives have been achieved.

Criterion 5, Curriculum, this criterion requires that subject areas appropriate to engineering, however, it does not prescribe specific courses must be taken by students. This criterion requires that a program curriculum devotes appropriate time and attention to subject areas aligned with the objectives of the program and mission of the institution. Engineering curriculum normally requires one year of a combination of college level mathematics and basic science and one and one-half year of engineering topics appropriate for the program of study. There are no minimum number of required hours for the general education courses, except these courses must be aligned with the program and the institution objectives.

Furthermore, the program is expected to periodically revisit its curriculum and maintain a strong tie with its industry advisory board, and solicit input regarding its content in order to achieve a high placement rate for the program graduates. Therefore, a strong, sustained and collaborative partnership with industry representatives is essential. Many engineering programs examined best practices of engaging members of industry advisory boards to elicit feedback, input and ideas that support effective assessment, refinement of curricula and continuous improvement. However, full benefits including experience and talents which abundantly exit in members of the advisory board are not utilized. It has been observed in many occasions that poorly managed and under-utilized advisory board rapidly either becomes ineffective or dissolved over a period of time.

3. Conclusion

Many engineering programs outside the United States have either recently gone through the ABET process or aligning their programs to meet the requirements to become an ABET accredited. ABET-accredited engineering programs must maintain and adapt curricula, student outcomes and educational objectives that reflect and respond to the needs of industry and the engineering discipline seeking accreditation.

References

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Biographies

Dr. Albertus Retnanto is Associate Professor of the Practice of Petroleum Engineering at Texas A&M University at Qatar and has been in the Petroleum Engineering program since 2009. He received his Ph.D. degree in Petroleum Engineering (1998) from Texas A&M University. He teaches undergraduate courses in numerical methods, well testing, petroleum production system, production engineering, petroleum technical presentation, natural gas engineering, and integrated asset development and makes significant curriculum enhancements to several courses. He held a Principal position with Schlumberger and has more than 18 years of experience worldwide in both technical and management positions in the area of well testing, field development, and production enhancement. He has received the Performed by Schlumberger Bronze Award four times. He has served as the Review Chairman of SPE Drilling & Completion Journal and chair on several committees on SPE. He received the A Peer Apart SPE Award, which is dedicated to the technical excellence of authors to the industry. He received the AFS College-level Distinguished Achievement Award in Teaching in 2016, SGA Educator Award, SEC Best Faculty Award, and the Faculty of the Year Award in five times, and the Distinguished Teaching Award. He has authored and co-authored over 35 papers. He is a PETE undergraduate advisor, and ABET/SAC coordinator.

Dr. Hamid R. Parsaei is a Professor of Mechanical Engineering at Texas A&M University at Qatar (TAMUQ). Additionally, he holds the rank of professor in the Department of Industrial and Systems Engineering and Department of Mechanical Engineering at Texas A&M University in College Station, Texas. Dr. Parsaei is a fellow of the Institute of Industrial and Systems Engineers (IISE) and the American Society for Engineering Education (ASEE). He is a leader in advancing teaching and learning by developing new initiatives for using technology in the classroom and enhancing excellence through diversity in educational programs. He has been a frequent speaker at national and international conferences on engineering education and the use of technology to further improve teaching and learning. His research currently focuses on application of optimization techniques to emergency evacuations and disaster mitigation. He has published over 280 articles in the peer reviewed journals and conference proceedings. He has authored and edited 24 text and referenced books including those in progress. He has served as an ABET Program Evaluator (PEV) for the Engineering Accreditation Commission representing the Institute of Industrial and Systems Engineers since 2006. He has served as the college wide ABET Coordinator at Texas A&M University at Qatar. Dr. Parsaei served as professor and chair of the Department of Industrial Engineering at the University of Houston (January 2001- August 2010) and Associate Dean for Academic Affairs at Texas A&M University at Qatar (September 2010-Augustu 2014). Dr. Parsaei is a registered professional engineer in Texas.

Boback Parsaei holds B.S. and M. Engr. in Civil Engineering from Texas Tech University and Texas A&M University, respectively. He has served as a senior consultant with Integrated Technology Systems, Inc. He is co-editor of the CRC Press book series on Technology Guides: Advancing Capacity Building in Contemporary Organizations and co-author of an upcoming CRC Press book, Leadership Excellence in Dynamic Organizations: The Art of Developing Leaders. Mr. Parsaei has presented several papers at international conferences on leadership, project management, and engineering education. He is currently a doctoral candidate in the Department of Civil and Environmental Engineering at Texas A&M University.