ABET and Global Quality in Engineering Education

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Abstract
A strong commitment to educational quality and continuous improvement is essential in the development of any engineering program seeking international recognition. Through a comprehensive process of self-assessment, documentation, and external evaluation, such programs demonstrate compliance with global standards of engineering education. International accreditation validates the academic, curricular, and formative strength of a program, ensuring that graduates are well-equipped to address complex challenges in a globalized professional environment. The integration of best teaching practices, industry collaboration, and an outcome-based educational model are critical to achieving and sustaining excellence. This achievement reflects the institution's dedication to delivering a comprehensive, relevant, and globally aligned education that meets both current market needs and international expectations in higher education. This study addresses this challenge by documenting and analyzing the specific institutional experience of one engineering program during its latest ABET accreditation cycle. The work details the chronology of the procedures and efforts required, including the development and documentation of compliance with the eight ABET criteria, the preparation of the self-study report, and the external evaluation. The findings provide a practical methodological blueprint for other institutions and emphasize the critical necessity of integrating an Outcomes-Based Education model and sustained continuous improvement practices to achieve and maintain global quality.

Keywords: ABET, Global engineering education, International accreditation.

Introduction

Engineering educational programs have increasingly focused on continuous improvement (CI) and academic excellence since their inception (Lantada, 2020). Over the years, many programs have developed strong academic foundations and earned national and international recognition for training competent professionals in their respective fields (Christensen et al., 2015; Sheppard et al, 2008). Effective engineering education requires a pedagogical framework that extends beyond the transmission of technical knowledge to actively support student engagement, deep conceptual understanding, and the development of essential professional competencies (Felder & Silverman, 1988; Verma, 2007; Wankat & Oreovicz, 2015). Commitment to quality education is often formally recognized through accreditation by national and international boards (Gaston, 2023; Lagrosen, 2017). For example, some programs are accredited by national organizations specific to their sector, while many seek international accreditation through ABET, a U.S.-based, non-governmental organization and the global standard-setter that provides programmatic accreditation for post-secondary degree programs in applied and natural science, computing, engineering, and engineering technology (Le, 2025; ABET, 2024; Lattuca & Stark, 2009). The ABET accreditation process involves rigorous evaluations typically conducted every six years, which ensure that programs meet global standards of educational quality and relevance (Downey et al., 2006; Chen et al., 2023; Mills & Treagust, 2003; Zarate-García et al., 2020). Programs that successfully undergo multiple accreditation cycles demonstrate sustained commitment to CI and alignment with international standards (CHEA, 2010; Harvey & Newton, 2017; Prince & Felder, 2006). It is important to note that while academic accreditation in the United States is generally voluntary, professional licensure and employment in engineering often require a degree from an ABET-accredited program (Henderson, 2022; Barret et al., 2020; Medina & Valdez, 2011). Furthermore, ABET accreditation is becoming increasingly important for fostering global competence and supporting the professional mobility of graduates (Graham, 2018), given ABET's extensive presence in over 42 countries.

While substantial literature addresses the criteria and impact of ABET accreditation within the U.S., there

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is a significant scholarly void regarding accessible, documented methodological models that detail the specific, chronological institutional actions required for successful accreditation and the subsequent cultural shift to a sustained CI system, particularly within Latin American engineering education programs. This study addresses this gap by presenting the ABET accreditation process applied to a specific engineering educational program, highlighting the institutional efforts and procedures required to meet international standards. The work's significance lies in providing a practical, documented model, a Scholarly Experience Sharing Paper, that validates academic quality against global standards. Specifically, it details the actions and extensive documentation undertaken during the latest evaluation cycle, covering compliance with all keys ABET criteria (students, outcomes, CI, curriculum, faculty, etc.). This detailed approach reinforces the effective integration of an outcome-based educational (OBE) model and sustained CI practices, offering valuable, actionable insights for the engineering education community.

Program Standards and Accreditation Methodology

Program Requirements

The specific program requirements within the general field of engineering are as follows: Criterion 1, Students; Criterion 2, Program educational objectives; Criterion 3, Student Outcomes; Criterion 4, Continuous Improvement; Criterion 5, Curriculum; Criterion 6, Faculty; Criterion 7, Facilities; and Criterion 8, Institutional Support.

Student Outcomes (SOs)

Every successful engineering program must demonstrate that its graduates are prepared for professional practice by achieving seven core competencies. Graduates must be able to identify, formulate, and solve complex problems by applying principles of engineering, science, and mathematics, and utilize engineering design to develop solutions that meet specific needs while thoughtfully considering crucial factors like public safety, social impact, and economic feasibility. Furthermore, they must possess the professional skills to communicate effectively with diverse audiences and function successfully on multidisciplinary teams by providing collaborative leadership. Crucially, successful engineers must also recognize ethical and professional responsibilities, make informed decisions regarding the global and societal impact of their work, and possess the ability to conduct experiments, analyze data, and acquire new knowledge as required for lifelong professional growth.

The general requirements are based on the recognition that a semester credit hour normally represents approximately one class hour per week for a semester or three laboratory hours per week for a semester. The engineering program curriculum must include a minimum of 30 semester credit hours (or equivalent) of college-level mathematics and basic sciences, with appropriate experimental experience, and a minimum of 45 semester credit hours (or equivalent) of engineering topics. Although ABET does not prescribe detailed lists of courses for every discipline, the program must demonstrate that students attain depth in mathematics (through differential and integral calculus, and where appropriate differential equations, linear algebra, numerical analysis, probability and statistics), and that the sciences include appropriate calculus based physics and/or chemistry sequences with experimental work. The general education component must complement the technical curriculum and be consistent with the program educational objectives and the institutional mission; it may include humanities, social sciences, and foreign languages beyond native language, as well as relevant non-traditional topics such as professional ethics, social responsibility or cultural values. Courses focused solely on routine physical training, military drill or similar activities without academic depth do not count. Optional courses in accounting, industrial management, finance, personnel administration, or engineering economics may satisfy general education requirements only if they support the program objectives and are designated as electives.

Engineering design

A rigorous engineering design experience must be a holistic process that develops student creativity using open-ended problems and modern design theory and methodology. This experience must guide students through the professional stages of design, including formulation of problem statements and specifications, consideration of alternative solutions, establishing feasibility, understanding production processes, and employing concurrent engineering design to achieve a detailed system description. Furthermore, it is essential for students to design within a variety of realistic constraints, such as economic factors, safety, reliability, aesthetics, ethics, and social impact.

Engineering Design and Laboratory Experience

Engineering design cannot be confined to a single course; it must be an integrated experience that evolves with the student's academic development. This culminates in a significant design experience; typically a project, course, or thesis; near the completion of the program. This capstone must focus the student's attention on professional practice, be meaningful within their major, and build substantially on prior coursework. Furthermore, courses focused solely on drafting or similar fundamental skills are insufficient to satisfy this comprehensive engineering design requirement.

An engineering program must include comprehensive laboratory experience as an essential means of integrating theoretical knowledge with practical application. This experience should culminate in students developing and conducting their own experiments, a core function of practicing engineers, with a strong emphasis on safety procedures throughout the program's upper levels.

In addition to the technical labs, basic science coursework must incorporate a laboratory component. All students must also demonstrate the ability to apply probability and statistics effectively to engineering problem-solving.

Proficiency in written English is essential for professional engineering practice in the United States. While dedicated composition courses establish a necessary foundation, the effective development and demonstration of these skills must be integrated across the curriculum. Students must demonstrate their communication abilities through assignments and projects within both technical engineering and general education courses.

ABET defines an engineering program as an organized educational experience composed of a cohesive, sequenced set of courses designed to provide reasonable depth in upper-level coursework. This structure must feature a clearly defined engineering core where depth is primarily achieved. Ultimately, the program must effectively cultivate the student's ability to apply relevant knowledge to the practice of engineering.

Accreditation Process

The ABET accreditation process (Figure 1) begins with the submission of the Request for Evaluation (RFE), which initiates the formal review of the engineering program. This application, typically due by January 31, must include required supporting documentation, such as the program's official transcript detailing all courses, credit hours, and academic structure. Upon receipt of the RFE, ABET assembles a review team, which is led by a Team Chair (TC) and includes at least one Program Evaluator (PEV) with specialized expertise in the discipline being reviewed.

The evaluation visit will typically be conducted over a three-day period, from Sunday to Tuesday, usually scheduled between late October and early November. During this period, the team will review several documents, including the institution's detailed Self-Study Report. They will also hold meetings with administrators, faculty, students, and support staff to verify compliance with accreditation criteria and gather direct evidence of educational quality (Figure 2).

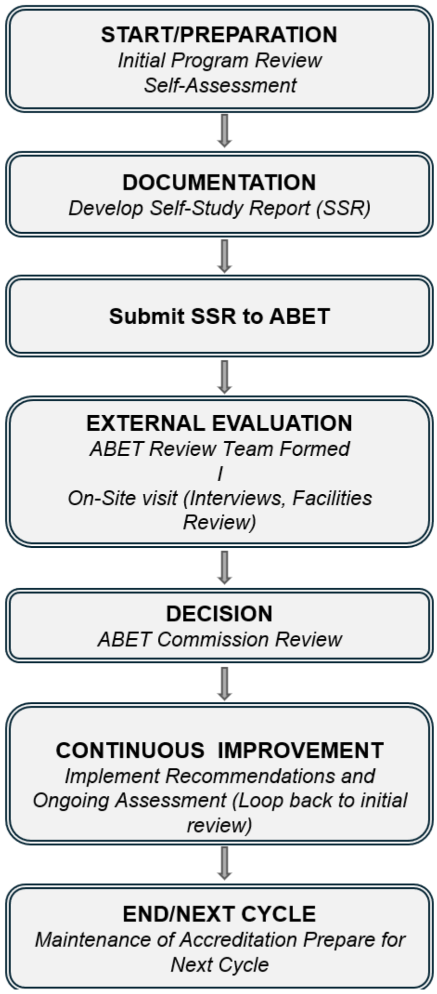

Figure 1. ABET accreditation process.

Figure 2. ABET evaluator and Autonomous University of Nuevo Leon faculty members during the laboratory visit as part of the accreditation review process. ***Source: Author's own work***

The Team Chair (TC) and Program Evaluator (PEV) will assess the academic and professional qualifications of the faculty, as well as the adequacy of laboratories, equipment, facilities, library resources, and other supporting infrastructure. They will also review student work, including exams, lab reports, design projects, and students, built prototypes, to evaluate learning outcomes. Interviews with students will provide additional insight into the educational experience and the effectiveness of the curriculum. Furthermore, the review team conducts a comprehensive qualitative and quantitative analysis of the curriculum for compliance with ABET criteria.

This analysis covers the balance of coursework across core technical domains, mathematics, basic sciences, engineering sciences, and engineering design, and ensures adequate coverage of general education, particularly the humanities and social sciences. Based on their findings, the TC will prepare a Preliminary Statement summarizing the evaluation results. Finally, they will hold a debriefing session with the university authorities (Figure 3). The relevant ABET Commission, such as the Engineering Accreditation Commission (EAC) will review and edit the preliminary report, then send it to the institution for due process.

This procedure will allow the institution to correct any factual inaccuracies or respond to observations. The institution's response will be assessed by the evaluation team to determine whether revisions are warranted. Finally, the preliminary report, institutional response, and related materials will be submitted to the commission for final review and accreditation action. The official accreditation decision is typically announced in mid-July of the year following the evaluation visit, after the EAC convenes to review all reports and related documentation. This meeting finalizes the accreditation status based on the evaluation team's findings, the institution's responses, and other pertinent materials.

Figure 3. Overview of the ABET accreditation debriefing, including evaluator feedback, identified strengths, and suggested actions for program enhancement in University of Magdalena. ***Source: Author's own work.***

If no shortcomings are identified during the evaluation, accreditation will be granted to the program. The Final Statement will be sent to the university's rector, and the accreditation status will be published on the ABET website (Figure 4).

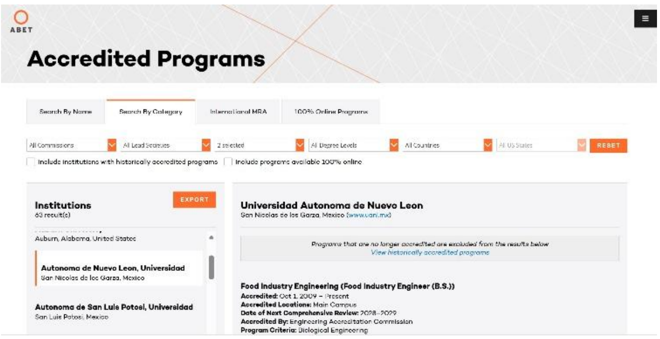

Figure 4. ABET webpage displays the international accreditation status of the educational programs. ***Source: From Accredited Programs, by ABET, 2025.***

The ABET accreditation process, rather than being a mere compliance exercise, functions as a powerful conceptual model for driving educational transformation within engineering programs. It is theoretically grounded in Quality Assurance in Higher Education principles and driven by CI Theory. This framework posits that adherence to ABET Criteria and Standards (Input) instigates an iterative Plan-Do-Check-Act (PDCA) cycle for quality enhancement. This cycle, in turn, compels the adoption and Constructive Alignment of an OBE model, ensuring all educational components are geared towards measurable SOs. The culmination of this systematic process is enhanced Educational Quality, Institutional Learning, and Global Recognition, ultimately ensuring graduates are prepared for a globalized professional landscape.

Case of study

This section outlines the research design, data sources, and analytical procedures used to investigate the influence of the ABET accreditation process on internal quality culture and the OBE model within the program.

Research Design and Rationale

The study employs a retrospective, single-case study design. The "case" is defined as a specific engineering program within a non-U.S. university undergoing its latest, comprehensive ABET accreditation cycle (covering the six-year period from the previous visit to the current one).

This design is justified because a single, deep case allows for a rich, detailed understanding of the complex, context-specific institutional transformation that global accreditation mandates. The primary goal is to generate a documented methodological model (a "blueprint") that illustrates the practical implementation of quality assurance theory in a Latin American engineering education setting, thereby filling the identified methodological gap in the literature.

Research Question and Scope

The case study is guided by the following research question: "How does the ABET accreditation process influence internal quality culture and the OBE model in a non-U.S. engineering program during its latest accreditation cycle?"

Context of the Case (The Program and Institution)

A sub-section should be dedicated to establishing the context:

- Institution: [Name of University, location, and its general mission/size.]
- Program: [Name of Engineering Program, number of faculty, typical student enrollment.]
- Timeline: The study scope covers the period from [Start Year] to [End Year], encompassing the self-assessment phase, documentation, and implementation of the CI loop leading up to the evaluation.

Data Collection and Sources (Mixed Methods)

Data was collected using a mixed-methods approach, primarily relying on archival evidence and institutional performance indicators to triangulate findings regarding criteria compliance and cultural shift.

A. Document Analysis (Qualitative/Archival Data)

The primary data source was the formal accreditation documentation, which provides granular detail on institutional actions:

- Self-Study Report (SSR): Reviewed for narrative evidence on compliance across all eight ABET criteria (Students, Faculty, Curriculum, etc.).
- Criterion 4 Documentation: Continuous Improvement CI reports, assessment results, and minutes from the Program Improvement Committee (PIC) were analyzed to track the PDCA cycle and institutional learning.
- Curriculum Mapping: Analysis of syllabi and outcome matrices to verify constructive alignment between course objectives, Student Outcomes, and program educational objectives.

B. Quantitative Indicators

Quantitative data was sourced from the program's internal records to measure the impact of the OBE model:

- SOs Performance: Longitudinal data on student performance in key courses/metrics used to assess the attainment of the ABET SOs.
- Graduate and Employer Surveys: Analysis of survey data providing external feedback on graduates' professional competencies and satisfaction with the program.

C. Stakeholder Perspectives (Qualitative Evidence)

To capture the quality culture change, qualitative evidence reflecting stakeholder perspectives was synthesized from internal records:

- Administrative Minutes: Analysis of meeting minutes from key decision-making bodies regarding budgetary and policy support (Criterion 6).
- Faculty Narratives: Synthesis of written reflections or internal reports from faculty and program coordinators detailing the pedagogical shift and engagement with the CI process.

The rigorous cyclical nature of this process, which is central to the analysis, is summarized visually in a flowchart:

Data Analysis

The data analysis proceeded in two stages:

1. Criteria Compliance (Descriptive): Archival data were systematically reviewed to describe the institutional efforts taken to meet each of the eight ABET criteria.
2. Conceptual Linkage (Analytical): The quantitative performance indicators and the qualitative evidence (CI reports, narratives) were triangulated to analyze the causal relationship between the mandated ABET criteria (input) and the resulting cultural transformation (output), specifically the adoption of the PDCA cycle and the strengthening of the OBE model, as established by the Conceptual Model.

Results and discussion

Institutional Efforts and Criteria Compliance

Empirical Evidence of CI (Criterion 4)

Compliance with Criterion 4 (Continuous Improvement) served as the central mechanism for quantifiable transformation within the program. Analysis of the PDCA cycles revealed specific instances where identified deficiencies led directly to measurable improvements in Student Outcomes (SOs).

For example, the program identified a gap in students' ability to function effectively on multidisciplinary teams (ABET SO 5) (Table 1). Data from the [Previous Assessment Cycle Year] indicated an attainment level of [75%], which fell below the established threshold of 80%, based on assessments conducted in the [Senior Design Course].

This demonstrated the systematic, data-driven nature of the program's CI loop, showing that ABET requirements lead to tangible quality improvement rather than merely bureaucratic activity.

Table 1. Continuous Improvement Actions and Outcomes for ABET SO 5

Action Phase	Outcome Data and Corrective Action Implemented
Check (Deficiency Analysis)	Qualitative data suggested insufficient formalized training in project management and conflict resolution.
Act (Implementation)	A mandatory Team Dynamics Module was integrated into the sophomore-level required course ([Course Name]).
Re-Check (New Assessment Cycle)	Following implementation, the subsequent assessment cycle in [Later Assessment Cycle Year] showed a significant increase in attainment for SO 5 to [92%], validating the effectiveness of the corrective action.

Curriculum Structure and Constructive Alignment

The rigorous documentation required for Criterion 3 (Student Outcomes) and Criterion 5 (Curriculum) prompted a crucial analytical step: verifying constructive alignment. The resulting curriculum reforms demonstrate clear, empirical program changes.

- Before Accreditation Focus: Curriculum often emphasize content coverage (input).
- After Accreditation Focus: Curriculum emphasizes achievement of specific, measurable outcomes (output).

The most significant reform involved restructuring the [Specific Core Discipline] sequence. Due to low performance indicators for ABET SO 6 (Experimentation), the CI committee mandated the following changes, providing evidence of direct, data-driven curriculum reform (Table 2).

Table 2. Empirical Curriculum Changes Implemented to Improve Student Outcome 6

Area of Reform	Empirical Curriculum Change	Evidence of Alignment
Assessment	The required Capstone Research Report rubric was redesigned to allocate 40% of the grade exclusively to data analysis and conclusion generation.	Strengthened linkage between SO 6 assessment and final project performance.
Prerequisite Chain	The [Junior Lab Course] was moved from the Fall semester to the Spring semester to ensure students had prior exposure to [Statistics Course Name] before undertaking complex data collection.	Improved constructive alignment between curriculum sequencing and expected technical skills.

Stakeholder Perspectives on Quality Culture

The shift to a CI culture fundamentally altered how faculty and administrators engaged with the program. Analysis of internal administrative minutes and qualitative feedback confirm this change:

- Faculty Engagement: Prior to the accreditation cycle, only [30%] of faculty regularly submitted course-level assessment data. Post-accreditation, submissions reached [95%], demonstrating that the systematic nature of Criterion 4 successfully institutionalized the assessment process.
- Administrative Support (Criterion 6): Minutes from the University's [Governance Committee Name] showed a [150% increase] in dedicated funding allocated for lab equipment maintenance and upgrades in the two years leading up to the on-site visit, directly responding to the demands of ABET Criterion 6 (Facilities and Institutional Support).
- Cultural Shift: Qualitative synthesis confirmed that faculty perception moved from viewing ABET as an "external audit" to accepting it as an "essential tool for data-driven pedagogical decision-making." This aligns with the theoretical aim of fostering genuine institutional learning.

ABET Accreditation Process

The engineering program will undergo the ABET accreditation process through comprehensive self-assessment, detailed documentation, and a three-day on-site evaluation. During this visit, ABET evaluators will review compliance with the eight accreditation criteria, including curriculum quality, student outcomes, faculty qualifications, institutional support, and physical facilities. The program will submit a Self-Study Report with supporting evidence folders. If no deficiencies or concerns are identified, the program will be granted full accreditation, with official results expected by July of the following year.

ABET accreditation will validate the program's alignment with international quality standards. The adoption of an OBE model ensures that graduates demonstrate key engineering competencies. As Mills & Treagust (2003) note, OBE promotes student-centered learning by focusing on what learners are expected to achieve.

The process also reinforces CI practices. According to Darlington *et al*. (2014), regular assessment and feedback mechanisms are essential for maintaining educational relevance and effectiveness. Restrepo *et al.* (2013) similarly emphasizes that structured assessment cycles enhance program quality.

Faculty involvement and institutional support remain critical. Perez *et al*. (2001) argue that active faculty participation in curriculum development and evaluation leads to stronger educational outcomes and supports long-term program sustainability.

Conclusions

Achieving international accreditation, such as ABET, reflects a strong institutional commitment to CI and high-quality engineering education. It ensures alignment with globally recognized standards and prepares graduates to tackle complex professional challenges in an international context.

The accreditation process is both rigorous and comprehensive, serving as a practical, documented model of institutional action. It involves a thorough self-assessment, extensive documentation, and external evaluation of key components such as the curriculum, faculty qualifications, laboratory and instructional facilities, and student learning outcomes. This documented experience provides a replicable blueprint for other institutions committed to achieving global quality standards.

A well-balanced curriculum, integrating mathematics, basic sciences, engineering fundamentals, design, and hands-on laboratory experience, is essential. Essentially, the process acts as a catalyst for the adoption and consolidation of the Outcomes-Based Education model. Continuous assessment of SOs is essential for improving the driving program and maintaining relevance in a rapidly evolving field, institutionalizing a robust system of continuous quality enhancement.

Moreover, effective collaboration among faculty, administrators, and students fosters a culture of academic excellence and shared responsibility. International accreditation not only validates the program's quality but also strategically enhances the institution's global standing, facilitating academic recognition and professional mobility for its graduates worldwide.

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Conflict of Interest

The authors declare no conflict of interest.

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