Equivalency of the Iraqi Accreditation Criteria for Engineering Education to ABET Criteria

Zeyad S. M. Khaled
Professor of Construction Engineering and Management,
PhD, Chairman of the Iraqi Council of Accreditation for Engineering Education.
zeyadsmkhalid@gmail.com

ABSTRACT

This paper compares the Iraqi National Accreditation Criteria for Engineering Education to the relevant general criteria of ABET in an attempt to find out the similarity between them. This is because ABET is one of the initial signatories to the Washington Accord which is managed by the International Engineering Alliance. The Washington Accord recognizes programs offering Bachelor's degrees in engineering accredited within the signatories' own jurisdictions. It is found that there are substantial similarities which should give confidence to accept joining the Washington Accord by the Iraqi Council of Accreditation for Engineering Education. The differences are also discussed.

Keywords: Engineering Education, Education Accreditation, Washington Accord, ABET, International Engineering Alliance.

INTRODUCTION

Forty four local professional engineering organizations that are involved in accrediting engineering education programs are signatories now to the Washington Accord. This Accord is an international mutual recognition agreement managed by the International Engineering Alliance (IEA). It only recognizes engineering programs accredited within the signatories' own jurisdictions. The signatories recognize the equivalency of programs accredited by each of them in satisfying the academic requirements for the practice of engineering [1]. The Washington Accord is also significant in the International Professional Engineers Agreement (IPEA) and the United States Council for International Engineering Practice too [2].

ABET is interested in programs accreditation of four degrees; Associate, BSc, MSc and Integrated BSc-MSc degrees. It consists of four commissions; Engineering Accreditation Commission (EAC), Engineering Technology Accreditation Commission (ETAC), Computing Accreditation Commission (CAC) and Applied and Natural Science Accreditation

Commission (ANSAC). The CAC and ANSAC do not accredit engineering programs and the EAC does not accredit programs for Associate degrees [3].

The Washington Accord recognizes engineering programs excluding Associate programs; Sydney Accord recognizes engineering technology programs excluding Associate programs whereas Associate programs are recognized in Dublin Accord[4].

ABET recognizes substantial equivalency through the Washington Accord. The term "Substantial equivalency" is not elaborated by the IEA, while ABET provides a definition which means that "the program is comparable in program content and educational experience, but may differ in format or method of delivery … the evaluations policies and procedures are similar to those used for accreditation" [5].

The Iraqi National Accreditation Criteria for Engineering Education has been declared by the Ministry of Higher Education and Scientific Research in Iraq in 2018. It was issued by the Quality Improvement Council for Engineering Education in Iraq (QICEE) which became the Iraqi Council of Accreditation for Engineering Education (ICAEE) in 2018. This council solely recognizes the BSc degrees in Engineering [6].

This paper explores the equivalency of ICAEE criteria compared to ABET - EAC criteria providing justification for any differences.

RESEARCH OBJECTIVES

The objectives of this research are:

1. To provide an insight look into ICAEE and ABET accreditation criteria.
2. To find out considerable differences between them.
3. To demonstrate that ICAEE accreditation criteria for BSc in engineering programs is equivalent to those of ABET.

This should give confidence to acknowledge ICAEE accredited programs by IEA.

METHODOLOGY

Material on ABET, IEA and ICAEE accreditation criteria, available on the Web, were thoroughly studied. Those material included websites, reports, issues and research articles. A comparison is made to investigate the equivalency of ICAEE accreditation criteria for Bachelor's degree in engineering programs based on ABET (EAC) accreditation criteria. Differences are justified by referring to other accreditation systems like the Engineering Council (EC) guidelines for accreditation in the UK.

THE WASHINGTON ACCORD

Before going through equivalency verification between ICAEE and ABET accreditation criteria, it is worthwhile to have a look on the Graduate Attributes set by the Washington Accord. The Washington Accord Knowledge Profile includes the following [4]:

WK1: "A systematic, theory-based understanding of the natural sciences applicable to the discipline."

WK2: "Conceptually-based mathematics, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modeling applicable to the discipline." WK3: "A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline."

WK4: "Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline." WK5: "Knowledge that supports engineering design in a practice area."

WK6: "Knowledge of engineering practice (technology) in the practice areas in the engineering discipline."

WK7: "Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the professional responsibility of an engineer to public safety; the impacts of engineering activity: economic, social, cultural, environmental and sustainability."

WK8: "Engagement with selected knowledge in the research literature of the discipline."

EQUIVALENCY VERIFICATION

The comparisons was carried out based on the accreditation criteria and the template of Self-Assessment Report adopted by ICAEE and ABET [6], [7[, [8] and [9].

The Criterion Related to Program Educational Objectives

ICAEE Criterion 1 (PEOs) has wider guidelines than ABET Criterion 2 (PEOs) in order to ensure the adoption of strategic planning by Iraqi education institutions. Both criteria require that the program has published PEOs which are periodically and systematically reviewed. PEOs should be consistent with the mission of the institution and meet the needs of the

constituents where programs constituents should be identified. Both systems require an Industrial Advisory Board to exist in the program.

ICAEE Criterion 1 (PEOs) added that the program should have an approved, realistic and achievable strategic plan including the Program Educational Objectives. The institution should have published vision, mission, values and strategic objectives. It must also have well-documented action plans to fulfill the objectives.

The Criterion Related to Learning Outcomes

Learning Outcomes are the knowledge, skills and attitudes that students should acquire at the end of the program. They should be clearly related to PEOs. Table (1) shows the substantial similarity of the seven Learning Outcomes of ICAEE Criterion 2 (Graduate Outcomes) and ABET Criterion 3 (Student Outcomes). Both systems require well-documentation of published Learning Outcomes that should at least include these seven outcomes.

Table 1: ICAEE Graduate Outcomes vs. ABET Student Outcomes

ABET Student Outcomes	ICAEE Graduate Outcomes
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	i) An ability to distinguish, identify, define, formulate, and solve engineering problems by applying principles of engineering, science and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	ii) An ability to produce engineering designs that meet desired needs within certain constraints by applying both analysis and synthesis in the design process.
3. An ability to communicate effectively with a range of audiences.	iv) An ability to skillfully communicate orally with a gathering of people and in writing with various managerial levels.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.	v) An ability to perceive ethical and professional responsibilities in engineering cases and make brilliant judgments taking into account the consequences in worldwide financial, ecological and societal considerations.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive	vii) An ability to work adequately on teams and to set up objectives, plan activities, meet due dates, and manage risk and uncertainty.

environment, establish goals, plan tasks, and meet objectives.	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	iii) An ability to create and carry out proper measurement and tests with quality assurance, analyze and interpret results, and utilize engineering judgment to make inferences.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	vi) An ability to perceive the continual necessity for professional knowledge growth and how to find, assess, assemble and apply it properly.

It is worthwhile to know that the Engineering Council (EC) guidelines for accreditation in the UK have 40 learning outcomes but they are grouped into six broad areas of learning namely; i) Science and Mathematics, ii) Engineering Analysis, iii) Design, iv) Economic, legal, social, ethical and environmental context, v) Engineering Practice and vi) Additional general skills [10]. A comparison of the seven Student Outcomes of ABET and the 40 EC learning outcomes shows that all are covered [2]. ABET and EC are amongst the founding signatory bodies of the Washington Accord [1].

The Criterion Related to Curriculum

The curriculum should aim at achieving the seven Learning Outcomes of ICAEE Criterion 2, which are compatible with those of ABET Criterion 3, therefore ICAEE Criterion 3 (Curriculum) is compatible with ABET Criterion 5 (Curriculum). Although both systems do not prescribe specific courses, they set three main components for the curriculum namely; i) 30 hr of Mathematics and Basic Sciences on minimum, ii) 45 hr of Engineering and Design on minimum, and iii) Others including general education. Nevertheless, ICAEE Criterion 3 refer to ICAEE Criterion 10 (Specific Program Criteria) which in turn advises the specific program to pay attention to the items of the relevant NCEES-FE in the USA as a guide to prescribe the courses.

It is worthwhile to know that “the Engineering Council (EC) guidelines for accreditation in the UK expect 33% of the curriculum to be devoted to the core subjects of the program. This is comparable to 1.5 years specified by ABET for engineering topics for a typical 4-year engineering degree program. The EC guidelines require mathematics and engineering sciences constitute 50% (two years) of the program. Similarly the EC expects broadening subjects outside of core engineering to form an important part of accredited programs.”

Taking into account that design is weaved like a thread throughout the curriculum, the program in both ICAEE and ABET criteria is expected to culminate in a capstone project at the final year as a major design practice that provide for individual creativity and innovation.

Furthermore, both systems ask for prerequisite structure of the curriculum, alignment with PEOs and attainment of the Learning Outcomes. Meanwhile

ICAEE Criterion 3 added another aspect concerning the adopted teaching and learning strategies because Iraqi education institutions are in need of changing from teacher-centered to student-centered education. The Engineering Council (EC) guidelines for accreditation in the UK for instance expect programs to demonstrate through their teaching and assessment methods that graduates have attained the required level [11].

The Criterion Related to Continuous Improvement

ICAEE Criterion 4 (Continuous Improvement) has similar guidelines to ABET Criterion 4 (Continuous Improvement) which requires a well-documented periodical assessment and evaluation processes for the expected level of Learning Outcomes attainment and the actions taken to fulfill that level. Both systems ask for reevaluation of changes in each Learning Outcome attainment and how it is used for continuous improvement of the program. ICAEE Criterion 4 has expanded the sub-area of Documentation which should be carried out by considering the principles of Total Quality Management System.

The Criterion Related to Students

ICAEE Criterion 5 (Students) has similar guidelines to ABET Criterion 1 (Students) which requires a well-documented monitoring and evaluation process for students' performance and progress, in a way that ensures fulfilling all graduation requirements, in addition to students' advising in both academic and professional matters. It also requires that the program have and enforce instructions and procedures for accepting new and transfer students.

The only difference found is that the ICAEE Criterion 5 didn't include one sub- area of ABET Criterion 1 entitled "Work in Lieu of Courses" because it is not applicable in Iraq. The absence of this item do not prevent ABET accreditation. Instead of that an additional sub-area is added to ICAEE Criterion 5 entitled "Extracurricular or off-class students' activities" because it needs to be paid more attention in Iraq.

The Criterion Related to Faculty

Both ICAEE Criterion 6 (Faculty) and ABET Criterion 6 (Faculty) expect the program to have sufficient Faculty number holding academic and professional qualifications suitable to cover all curricular areas and to provide adequate students advisory and mentoring. An indicator of their workload should be reported too. The program should also report on their professional licensure and experience in order to judge their competence especially those teaching design.

Although "ABET didn't set a proportion of faculty that should be licensed as professional engineers, the Engineering Council (EC) guidelines for accreditation in the UK for instance requires that 50% should be professionally qualified" [12].

In the sub-area of Faculty development, ICAEE Criterion 6 expects the program should report on their research activity too. The presence of postgraduate studies is also taken into consideration. This addition to the sub-area of Faculty development is due to factual need to promote scientific research in Iraq. The Engineering Council (EC) guidelines for accreditation in the UK for instance also expect the program to report on their research activity [2].

The Criterion Related to Institutional Support

ABET Criterion 8 (Institutional Support) covers both administrative and financial support together in the same criteria. ICAEE General Criteria separates them into ICAEE Criterion 7 (Administrative Support) and ICAEE Criterion 8 (Financial Support) because the main sector in the Iraqi higher education is governmental so being centrally funded by the government. Administrative support in both systems requires that leadership and administrative services should be adequate to ensure the quality and continuity of the program. It also includes reporting on Faculty recruitment, retention, promotion and development. The same is required for the technical and administrative staff.

Financial support in both systems requires reporting on all funding resources and how the program budget is adequate to ensure the quality and continuity of the program. This includes the financial support of the teaching and learning processes, facilities, Faculty and staff.

The Criterion Related to Facilities

Both ICAEE Criterion 9 (Facilities) and ABET Criterion 7 (Facilities) requires facilities to be adequate to fulfill the attainment of Learning Outcome.

Facilities include: offices, classrooms and laboratories including their equipment and instrumentation. Computing and library services are included too. Both systems also require that guidance on the use of these facilities is available. Moreover, maintenance and upgrading of facilities is also required to be reported. ICAEE Criterion 9 made more emphasis on health and safety precautions. It also added an aspect to emphasis on the Campus infrastructure facilities and student services.

CONCLUSIONS

This equivalency study shows that there is so much similarity between ICAEE and ABET criteria for accreditation of engineering programs. However there are a few additions in ICAEE criteria to emphasis on some local Iraqi needs. These additions can be summarized in the followings:

- Concerning the criterion of (Program Educational Objectives), ICAEE Criterion 1 requires that the program should have an approved, realistic and achievable strategic plan including the PEOs.

- Concerning the criterion of (Curriculum), ICAEE Criterion 3 requires taking into consideration the adopted teaching and learning strategies.

- Concerning the criterion of (Continuous Improvement), ICAEE Criterion 4 has expanded the sub-area of Documentation which should be carried out by considering the principles of Total Quality Management System.

- Concerning the criterion of (Students), ICAEE Criterion 5 requires paying attention to “Extracurricular or off-class students’ activities” too.

- Concerning the criterion of (Faculty), ICAEE Criterion 6 expects in the sub-area of Faculty Development, the program should report on research activities and the presence of postgraduate studies too.

- Concerning the criterion of (Institutional Support), ICAEE system preferred to separate it into two criteria; Criterion 7 (Administrative Support) and Criterion 8 (Financial Support).

- Concerning the criterion of (Facilities), ICAEE Criterion 9 made more emphasis on Health and Safety precautions. It also added an aspect to emphasis on the Campus infrastructure facilities and student services.

- Concerning the criterion of (Specific Program Criteria), ICAEE Criterion 10 advises the program to pay attention to the items of the relevant NCEES-FE in the USA as a guide to prescribe the courses.

On the other hand, the only difference found is the absence of one ABET sub-area entitled "Work in Lieu of Courses" in ICAEE Criterion of (Students) because it's not applicable in Iraq. The absence of this item do not harm ABET accreditation.

Finally, it can be noticed that both accreditation systems, ICAEE and ABET have comparable standards, outcomes, and processes, so this should give confidence to IEA to accept ICAEE joining the Washington Accord. The global engineering community looks to the Washington Accord as an exemplar of an international mutual recognition agreement as evidenced by the increasing number of signatories.

REFERENCES

[1] IEA (2014), "25 years Washington Accord",

http://www.ieagreements.org/assets/Uploads/Documents/History/25YearsW ashingtonAccord-A5booklet-FINAL.pdf.

[2] Anwar, A. and Richards, D., (2018), "Comparison of EC and ABET

Accreditation Criteria", available at https://www.researchgate.net/publication/321144393_A_comparison_of_E C_and_ABET_Accreditation_criteria.

[3] ABET (2018a), ABET website, https://www.abet.org/about-abet/governance/accreditation-commissions-2/.

[4] IEA (2017) "International Engineering Alliance: Educational Accords", http://www.ieagreements.org/assets/Uploads/Documents/Policy/IEA%20Ru les%20and%20Procedures%20(3%20June%20206).pdf.

[5] ABET (2018b), ABET website, http://www.abet.org/global- presence/substantial-equivalency-2/.

[6] QICEE (2018a), "The Iraqi National Accreditation Criteria for Engineering Education", Ministry of Higher Education and Scientific Research, Iraq.

[7] QICEE (2018b), "Template of the Self-Assessment Report for BSc in Engineering Programs", Ministry of Higher Education and Scientific Research, Iraq.

[8] ABET (2018c), "Criteria for Accrediting Engineering Programs", available at http://www.abet.org/accreditation/accreditation-criteria/criteria-for- accrediting-engineering-programs-2020-2021/.

[9] ABET (2018d), "Self-Study Report Template for Accrediting Engineering Programs", available at https://www.abet.org/accreditation/accreditation- criteria/self-study-templates/.

[10] EC (2017) https://www.engc.org.uk/international-activity/international- engineering-education-accords/.

[11] JBM (2021a), "Submission for Accreditation for Academic Courses leading to Engineering Council Registration", available at http://jbm.org.uk/downloads.aspx.

[12] JBM (2021b), "Guidance on the JBM Professional Qualifications Policy for Academic Staff", available at http://jbm.org.uk/downloads.aspx.

معادلة معايير الاعتماد العراقية للتعليم الهندسي مع معايير ABET

أ.د.زياد سليمان محمد خالد
رئيس المجلس العراقي لاعتماد التعليم الهندسي

المستخلص

تقارن هذه الورقة معايير الاعتماد الوطني العراقي للتعليم الهندسي بالمعايير العامة ذات الصلة لـ ABET لاجل معرفة التشابه بينهما .اذ يعترف اتفاق واشنطن بالبرامج التي تمنح درجة البكالوريوس في الهندسة المعتمدة ضمن النطاق الجغرافي لولاية الموقعين. وقد تبين ان هناك اوجه تشابه كبير مما يعطي الثقة لقبول الانضمام الى اتفاق واشنطن من قبل المجلس العراقي لاعتماد التعليم الهندسي. كما تمت مناقشة الاختلافات ايضا.