

Promotion and sustainability of quality assurance in engineering education through academic and professional accreditation

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ABSTRACT: Engineering accreditation is a fiduciary requirement for academic institutions to meet certain educational standards during the period of registration of such institutions. The status of accreditation should be continuously monitored to ensure that those standards are maintained. The authors opine that accreditation enhances quality and sustainability of engineering education. The totality of quality and sustainability of engineering education includes the provision of adequate resources, supply of well qualified applicants from lower-level schools, availability of robust academics, design and delivery of excellent curricula, graduation of students who are registrable by professional bodies and employable by public and private sectors of the economy. However, sustainability in engineering education extends to other dimensions, mainly its integration of curricula and also professional development. Accreditation ensures that qualifications meet quality assurance standards and requirements, establishes a mechanism for verifying qualifications and learning outcomes and articulation strategies. All of these measures can create long term trust in qualifications and enhance movement of learners and graduates across national boundaries.

Keywords: Accreditation, quality assurance, engineering education, outcome-based education

INTRODUCTION

Accreditation is considered as a powerful tool of quality assurance, especially in higher education. However, accreditation in general covers a lot more ground, as it may cover a much broader spectrum including many types and levels of education. In consequence, accreditation may have a different meaning to different people. For example, depending on the profession, any member of the so-called regulated profession (e.g. engineers, doctors, nurses) would consider accreditation as professional accreditation dealt with by a professional body. However, for a graduate of other professions, though still holding a degree, it is rather academic accreditation (being it either institutional or programme specific) that is prevalent.

TRADITIONAL VS OUTCOME-BASED EDUCATION

Accreditation standards are derived from the philosophy, paradigm and principles of the outcome-based education (OBE) model. Those principles are used in professional accreditation, like in case of engineering accreditation [1][2], where these standards are defined by the International Engineering Alliance and the Washington Accord for the worldwide equivalency and quality assurance of engineering programmes at tertiary level [3].

The Washington Accord was formed in 1989 as an international agreement among professional bodies responsible for accrediting engineering degree programmes initially in some English-speaking countries. Over the years, the Accord has been expanded and now includes professional bodies in several parts of the world, including Russia and China.

Basically, the Accord promotes the equivalency of accredited programmes and recommends that graduates of programmes accredited by any of the signatory bodies be mutually recognised and accepted by the other signatories as having met the academic requirements for entry to the practice of engineering in member countries. There are currently 25 members of the Accord [4]. The Washington Accord's programme requirements are designed on the principles of OBE.

Also, for academic accreditation, the OBE model has become a standard used in all institutions like the European Association for Quality Assurance in Higher Education (ENQA), Quality Assurance Agency for Higher Education (QAA), British Accreditation Council (BAC), Tertiary Education Quality & Standards Agency (TEQSA) or the Council for Higher Education Accreditation (CHEA), the Agency for Quality Assurance through Accreditation of Study Programs (AQAS) [5].

Outcome-based education (OBE) is a student-centred teaching and learning approach which attempts to replace the traditional education system that focuses on what is taught. It can be considered as the reformed concept of education which requires shifting curricula, staff and students' approach, and the support system for education.

ACCREDITATION

The word accreditation in an educational context refers to the fact that an institution or an academic programme is officially recognised, accepted or approved in terms of its status. Accreditation principally implies reaching certain predetermined requirements, criteria or standards of quality assurance. It confirms to the public that an educational institution has met and is maintaining a high level of standards set by an accrediting agency. Beyond ensuring quality standards, accreditation encourages institutions to identify and implement good practices that are functional for continuous improvement [6]. This process not only focuses on the outcomes but also emphasises the importance of the process by which these outcomes are achieved, fostering a shift in the way academic institutions reflect on their practices. In this way, accreditation becomes a vehicle for quality enhancement, promoting systematic management and monitoring of educational processes to achieve excellence.

Accreditation is extremely important to an institution, its staff, as well as current or potential students. It demonstrates a commitment of the institution to excellence, continuous improvement, and meeting national and international standards.

Despite criticism and discussions that there is little empirical proof that accredited universities and programmes are superior to non-accredited ones, accreditation is still considered as the system to assess, sustain and enhance the quality of higher education and its graduates. Yet there are doubts as pertaining to accreditation's worth, sincerity, effect and its value in improving quality [7][8]. Not all academic staff have a good understanding of accreditation and the process of achieving it [9].

Accreditation implies an enormous amount of work and pressure on the institution by for example asking higher education governance to change the way they plan, implement and measure their strategy and use of resources, and teaching staff to change the usual approach to teaching and learning and then adopting OBE; the paradigm actually needs a change in the culture as well. Also, increases in workload negatively affect time available for research, reduce time spent on actual teaching and attending to students' educational needs, and generally create some uncertainty about its effectiveness and possible conflicts within the institution or department. It carries additional costs and, prosaically, demands an incredible amount of paperwork, including time associated with its processing and preparation of supporting documents. With the general tendency at universities of ignoring educational achievements or simple tasks, the time spent on accreditation issues is usually underestimated and not adequately rewarded during staff performance assessment. This may delay (or even deny) staff promotion or tenure for deserving academics.

However, the discourse of whether accreditation is a valuable tool to improve programmes is immaterial as such discussions are not sustainable. Following the well-known mantra *publish or perish* describing the pressure to publish academic work, the same may be applied to accreditation: *be accredited or be irrelevant*.

Educational accreditation implies that an institution or a particular programme is reviewed by an external body to assess its standard, normally according to a certain predetermined set of norms. Typically, educational accreditation is processed and granted by a government organisation. However, there is also another type of accreditation that is external to government, especially for professional degrees (registered professions). Such a system was originally developed in the late 19th and the early 20th century in the USA as a forerunner of, what now would be called articulation, which was *used by a college or university to convince other institutions that its students and courses should be recognised by them, and vice versa* [10].

In the Southern African Development Community (SADC), there is a network of qualifications authorities across its member countries. These authorities are part of the SADC Qualifications Verification Network (SADCQVN), which works towards the recognition of qualifications across the region. Some of the members of the network are: The Botswana Qualifications Authority (BQA), Eswatini Higher Education Council (EHEC), Namibia Qualifications Authority (NQA), South African Qualifications Authority (SAQA) and Zambia Qualifications Authority (ZQA).

There are two primary categories of accreditation in education, both important:

- Academic (either institutional or for a particular programme of study in an institution);
- Professional (or specialised).

ACADEMIC ACCREDITATION

Academic accreditation can take the form of either institutional or programmatic accreditation and is done by an accrediting body established by either government or any designated body, but the one which is representing educational rather than professional organisation.

Both, the USA and Canada subject their tertiary institutions to the institutional accreditation, executed in the USA by regional bodies, whereas in Canada by the entities controlled by provincial governments. In Italy, quality assurance in higher education is guaranteed through both internal and external evaluation defined by national law and is based on the ENQA framework. The external evaluation is under the responsibility of an autonomous national agency (Agenzia Nazionale di Valutazione del Sistema Universitario e della Ricerca - ANVUR) supervised by the central government.

Institutional accreditation is a comprehensive evaluation of an entire educational institution, including its mission, academic programmes, assessment procedures, policies, resources, faculty and student services. The terms refer to the accreditation of the whole institution, including all its programmes (Bachelor, Master and PhDs), sites offering those programmes, and methods of delivery, without any implication as to the quality of the study programmes of the institution. It proves that an institution meets minimum standards for quality and integrity. Accreditation by those agencies ensures that such institutions meet certain criteria for federal, national or local government funding.

However, more popular is the system where national bodies, being government departments or government-initiated agencies, such as the South African Qualifications Authority (SAQA), New Zealand Qualifications and Credentials Framework (NZQCF), Tertiary Education Quality & Standards Agency (TEQSA) or the Botswana Qualifications Authority (BQA), register an institution as higher education provider, whereas accreditation is done for a particular programme - programmatic accreditation.

Programmatic accreditation evaluates specific academic programmes within an institution. This type of accreditation is important for several reasons, but mainly because it ensures that a programme meets rigorous academic standards and prepares students for their chosen careers. Therefore, accreditation provides assurance to students, employers and other stakeholders that graduates possess the necessary knowledge and skills for professional practice. Institutional accreditation provides a broad evaluation of an institution's overall quality, while programmatic accreditation focuses on specific academic programmes. Both types of accreditations are crucial as they confirm that students receive a high-quality education that meets rigorous international academic standards.

ENGINEERING ACCREDITATION

Programme accreditation may have two implications; namely, it has a proper academic status, and it declares graduates are competent to practice a profession. It is clearly the latter one which refers to the accreditation of engineering programmes [11].

In general, professional accreditation (or sometimes termed specialised accreditation) is the process (or the outcome of the process) by which a programme of study is validated by a professional or regulatory body as a programme that instilled into graduates the competencies required for professional practice and registration in a regulated profession. It may be considered as a statement by an independent authority to current or potential students of an educational programme validating educational processes and product quality.

Accreditation is the central instrument for quality assurance in engineering education but also for international recognition, benchmarking, sustainability of programmes, and finally, an instrument to attract students and funding. Therefore, it has a clear appeal to programme and university administrators as it may result in higher student intake and enrolment. Whether it has an appeal to the teaching staff, as mentioned before, may be debatable and not too convincing.

There is also an additional element usually not mentioned which is the problem of *ordinary* lecturers who have no clue about OBE, accreditation, regulators, accrediting agencies and their requirements. Even staff who are quite familiar with the concept of accreditation may be lost in the plethora of institutions performing the process or just being an *umbrella* above accrediting organisation. It has been a constant and reasonable question by engineering staff at some of the European universities why some European programmes are not accredited by an organisation which is part of the Washington Accord? Why have the European Network for Engineering Accreditation (ENAE), with its country members (again not very recognised organisations) with no relation to the Washington Accord?

It may be the reason that in some countries not many engineering programmes are accredited. For example, out of the 1,018 engineering programmes in Poland [10], only 73 (7.2%) are registered by the Accreditation Commission of Universities of Technology (KAUT) - a Polish accreditation agency, member of ENAE [12]. Frankly, not many engineering lecturers ever heard about KAUT or ENAE, although they certainly heard about the Polish Accreditation Committee (PAK), an organisation performing compulsory academic accreditation, required by the Ministry of Education.

As of today, Agenzia per la Certificazione di Qualità e l'Accreditamento EUR-ACE dei Corsi di Studio in Ingegneria (QUACING) has accredited not more than 50 Italian study programmes out of over 800 engineering programmes. In Italy, not many engineering faculty members and experts in institutional accreditation have heard of QUACING, given the significant effort that engineering programmes must make to comply with the quality assurance requirements set by the ANVUR standard framework, which allows the programmes to issue legally recognised degrees.

It is worth mentioning, that among European members of ENAE only Engineers Ireland, the Engineering Council of the United Kingdom and the Association for Engineering Education of Russia are also signatories of the Washington

Accord. However, it has been reported that both organisations started *strategic discussion* in 2019, though so far there is no information on the results of that discussion.

In the African context, no engineering programme may normally be offered in a country if it has not been accredited by relevant institutional and programmatic regulator, such as SAQA, BQA, NQA and other regulatory bodies. The Engineering Council of South Africa (ECSA) and the Engineers Registration Board (ERB) have the mandate to provide professional accreditation in South Africa and Botswana, respectively.

SUSTAINABILITY OF ACCREDITATION

Sustainability can be defined as the ability to maintain or support a process over time. Traditionally, sustainability is broken into three core concepts: economic, environmental and social. However, sustainability in the educational context should also be considered. In order to achieve sustainability in educational practices, it is not only necessary to develop a suitable curriculum and enhance programme structure but also to fundamentally adjust culture and organisational processes across institutions. Sustained quality practices help learners to comprehend and acquire knowledge and develop required skills. It can be argued that the primary condition to achieve the above rests in human development, especially in knowledge and abilities of teaching staff, as well as their motivation and continuous improvement. Active involvement of all staff of the institution, though especially teaching staff, helps to make quality issues sustainable rather than a one-time effort.

The other important factors include effective planning, provision of financial resources, availability of continuous stream of well-qualified potential students, supply of physical infrastructure, support of administration and institution's authority, all elements important and inevitable for sustainable development of an educational institution. Factors normally not examined, such as improvement in trustworthiness within the organisation, reflection on the quality assurance efforts (not necessarily only accreditation) and general acceptance of quality (including accreditation) by staff may also play an important role in the ability of the institution to foster sustainable quality practices. Global accrediting systems for engineering education may provide the necessary momentum towards achieving sustainable education, denoting the ability to maintain and support quality (and its improvement) of programmes and hence the quality of graduates.

Also, accreditation is important in achieving sustainability in the career paths of graduate engineers. In that respect international recognition of students' education is a significant asset. Accreditation gives a certain global perspective on education and by considering or even comparing educational approaches of two or more institutions, sustainability in engineering education can be established and enhanced. One of the outcomes of examining a curriculum, which is an obvious step in the accreditation process, is to consider updates in the curriculum. Also, the identification of the strengths and weaknesses of different educational models, may lead to designing programmes that encompass sustainable practices.

In that context, understanding educational practices of different countries, should give a varying perspective to the educators as well as students, fostering a deeper appreciation for sustainable engineering solutions beyond geographical borders. Deeper knowledge of educational standards, again an obvious outcome of the accreditation exercise, can steer educational institutions in aligning programmes with international requirements, which may consequently lead to promoting a sustainable and skilled engineering workforce.

Discussing sustainability in the context of accreditation should also indicate integration of sustainability-related topics in the curriculum. The accreditation requirements ensure that sustainability is tackled in discipline-based, specific courses, and to a greater extent, in the final year project (or capstone design project) [13]. Precisely, project and problem-based educational approaches are the most suited to develop and strengthen students' sustainability knowledge and skills [14]. However, emphasis of the graduate attributes by the Washington Accord, particularly sustainability considerations, have gradually increased over the years [15]. It is the appreciation of these considerations that should enable students to develop an accurate understanding of the impact of engineering on the environment and society, directing more reliable, sensible and sustainable engineering practices. Overall, fulfilling accreditation requirements, in terms of the attributes, especially related to sustainability, contributes to the ongoing efforts for engineering education to receive a broader view of sustainability, and its importance in shaping the future of the world.

CONCLUSIONS

Engineering accreditation is almost a compulsory requirement for academic institutions to prove and show that they meet certain educational standards. And despite its shortcomings, accreditation may provide several benefits to the quality and sustainability of engineering programmes; the essence of the process is to ensure quality by providing accountability and imbuing transparency.

As the ultimate goal of an educational programme is to produce graduates who would be able to advance the profession, accreditation is generally expected by employers and subsequently adopted by the majority of all engineering programmes. It can be summarised that it gives the *seal of approval* regarding the programme and moreover enhances a stronger internationalisation of the programme. However, it also gives programme leaders and staff an opportunity to reflect on its educational goals, methods and achievements, and helps them to identify areas for enhancement and to

continuously improve the quality. That in essence stipulates the sustainability of accreditation. Also, sustainability in engineering education should be discussed in terms of its integration in curricula and its importance in professional development of the graduates.

The status of accreditation should be continuously monitored to ensure that those standards are maintained. Accreditation ensures that qualifications meet quality assurance standards and requirements, establishes a mechanism for verifying qualifications and learning outcomes and articulation strategies. All of these measures can create long-term trust in qualifications and enhance the movement of learners and graduates across national boundaries.

Another issue raised in this article concerned academic and professional accreditation. Both obviously use similar frameworks and processes, and from an educational perspective, both are important for ensuring that students receive a high-quality education. However, in terms of recognition, benchmarking and graduates achieving engineering-oriented outcomes, professional accreditation should be more widely disseminated and reinforced to produce professionals capable of responding to contemporary challenges on an international scale.

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BIOGRAPHIES



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