

4. QUALITY AND ACCREDITATION IN ENGINEERING EDUCATION IN EUROPE

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Summary

Since the 2005 Ministers’ Conference in Bergen, that adopted the “European Standards and Guidelines for Quality Assurance in the European Higher Education Area” (“ESG”), Quality Assurance (QA) of Higher Education (HE) has become a major objective of the “Bologna Process”, the process that aims at harmonizing HE throughout Europe. At present, QA Agencies (or analogous bodies) exist, in practically every country of the European Union (and in most of the 47 countries of the European HE Area - EHEA), and the “European Quality Assurance Register of Higher Education” (EQAR) has been established. This is, indeed, a great positive progress, because of the contribution that QA can give to the general improvement of Higher Education.

However, QA often tends to assess more the “process” than the “contents” of the education: therefore, especially in subjects that lead towards a “profession” (“engineering” first among them), the practice of “accreditation” is also increasing throughout the world. In “accrediting” higher education, different approaches are possible: in particular, “programme” and “institutional”. However, the two approaches are not in contrast, but on the contrary can usefully complement each other.

Two recent initiatives in programme approach, will be quoted in the last part of the paper. First, the EUR-ACE® system for the “European accreditation of engineering programmes” at the Bachelor and Master levels, run by the “European Network for the Accreditation of Engineering Education” (ENAE) since 2006. Second, the Foundation in November 2011 of the “European Alliance for Subject-Specific and Professional Accreditation and Quality Assurance” (EASPA), the European analogous of the older American “Association of Specialized and Professional Accreditors” (ASPA).

The “Bologna Process” started with a “Joint Declaration of the European Ministers of Education”, signed by the Ministers of 29 European countries convened in Bologna (Italy) on 19th June 1999. The process has, then

proceeded, through a series of biennial Conferences (the latest one held in Bucharest on 26-27 April 2012) that, at present, involve 47 countries (from Portugal to Kazakhstan), forming the “European Higher Education Area” (EHEA),

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plus the European Commission. The objectives of the Bologna Process have been clarified and expanded by the “communiqués” of the successive Conferences, but the main objectives stated in the 1999 Declaration are still valid, and extracts from that Declaration can summarize them well:

- Adoption of a system of easily readable and comparable degrees ... in order to promote European citizens' employability and the international competitiveness of the European higher education system.
- Adoption of a system essentially based on two main cycles, undergraduate and graduate. Access to the second cycle, shall require successful completion of first cycle studies, lasting a minimum of three years. The degree awarded after the first cycle shall also be relevant to the European labour market at an appropriate level of qualification. [The communiqué of the 2007 London Conference referred for the first time to “an EHEA based on a three-cycle degree system”, adding the third cycle, the Doctorate.]
- Establishment of the system of credits
- Promotion of mobility by overcoming obstacles to the effective exercise of free movement ... for students, ... for teachers, researches and administrative staff ...
- Promotion of European co-operation in quality assurance with a view to develop comparable criteria and methodologies
- Promotion of the necessary European dimensions in higher education, particularly with regards to curricular development, inter-institutional co-operation, mobility schemes and integrated programmes of study, training and research.

Quality assurance (QA) of higher education (HE), already mentioned in the 1999 Bologna Declaration, has gradually become a major concern of the “Bologna Process”. The turning

point was the 2005 Ministers' Conference in Bergen, that adopted the “European Standards and Guidelines for Quality Assurance in the European Higher Education Area” (better known with the acronym “ESG”) [1]. At present, QA Agencies (or analogous bodies) exist in practically every country of the European Union (and in most EHEA countries) and are listed in an ad-hoc official “European Quality Assurance Register of Higher Education” (EQAR). Indeed, this is great progress since a couple of decades ago, because QA greatly contributes to the improvement of HE.

The ESG distinguish between “Internal Quality Assurance”, practiced within each Higher Education Institute (HEI), and “External Quality Assurance” by a third-party independent body. However, if not properly intended and applied, these procedures may have great limitations, and even become a hindrance

For instance: within ESG Part 1 on “Internal Quality Assurance”, Section 1.3 “Assessment of students” specifies that “*Students should be assessed using published criteria, regulations and procedures which are applied consistently*” and that “*Student assessment procedures are expected to:*

- be designed to measure the achievement of the intended learning outcomes and other programme objectives; ...”

but the ESG, nowhere define the “intended learning outcomes”. Only in later ENQA documents (such as [2]), one can read that:

“Learning outcomes (LOs) are statements of what a student should know, understand and/or be able to demonstrate after completion of a process of learning.”

Assessment of students is not mentioned at all in Part 2 of the ESG, that deals with “External Quality Assurance”: essentially QA of the HE Institutions, of which I do not deny the importance; however, I do believe that too often it tends to assess more the “process” than the “contents” of the education.

To avoid this, I maintain that it is necessary to formulate *explicit learning outcomes*, specific for each discipline (and sometimes for sub-disciplines or “branches”).

[A distinction should also be made between “*intended LOs*” (sometimes called “*programme outcomes*”) and “*achieved LOs*”. How to assess the latter, is one of the biggest open problems of QA, still far from a satisfactory solution; that, I believe, will engage experts and organizations for years to come. But I do not want to deal with this question, that is currently tackled by the very ambitious “AHELO” (Assessment of Higher Education Learning Outcomes) project supported by the OECD Directorate for Education.]

Here, there comes the distinction between “*field-specific*” and “*general*” QA approaches, that, in turn, lead naturally to “*institutional*” and “*programme*” evaluation and accreditation. Institutional and programme approaches share most of their “technical” instruments and procedures: self evaluation reports, peer reviews, benchmarks vs. reference points, etc.; but, as an ENQA Report of a few years ago recognised, while the institutional approach assesses the internal monitoring and QA arrangements, allows for more flexibility in terms of structure, content and implementation of study programmes, and emphasises the autonomy and the primary responsibility of the Institutions for their quality, the contents of programmes are not thoroughly examined.

The latter is a great liability, especially in fields like engineering. In the closing Conference of the EUR-ACE SPREAD project (25 October 2010) the invited speaker from the European University Association (EUA) recognized that in QA procedures there is “no discontinuity between institutional and programmes levels, where both are consistent with ESG”, and that programme approaches are “particularly relevant for disciplines relevant to public health and safety”, like engineering, and which - I add - in several countries require a “licence” to be

practiced.

Therefore, I strongly maintain that the two approaches are not in contrast, but can complement each other: the choice should never be “either - or”, but how best to combine the two approaches in order to optimize the results while limiting the burden placed on the HE Institutions and their members. In short, I would say that “*institutional accreditation*” is essential to guarantee the “quality” of the educational process, since only well-structured HE Institutions can provide reliable education; while “*programme accreditation*”, on the basis of accepted learning outcomes, is essential to assure “relevance for the job” besides “academic quality” of educational programmes.

Indeed, field-specific QA approaches accentuate the need for aligning the goals of educational programmes with the expectations of the stakeholders, and underline that Higher Education Institutions, while in principle autonomous, are nevertheless accountable to their constituents, which includes an obligation to demonstrate the “relevance” of their output. Thus, as underlined in several papers, e.g.[3], field-specific QA systems give credibility and concreteness to the whole “Bologna”/EHEA system. For the EU countries, the link to the relevant social and economical issue of employability is further stressed and strengthened by the “Directive for Recognition of Professional Qualifications” [4], at present under review.

However, in higher education, several definitions of the word “*accreditation*” are possible, that may involve its significance and relevance. It is therefore appropriate to report here the definition given in the EUR-ACE Framework Standards [5] (of which I will speak later), that, in turn, derives from definitions included in several recent national Engineering Standards:-

“Accreditation of an engineering educational programme is the primary result of a process used to ensure the suitability of that programme

as the entry route to the engineering profession", by means of:-

- *Periodic assessment against accepted standards*
- *Peer review of written and oral information by trained and independent panels including academics and professionals by verifying the achievement of agreed outcomes*

In this definition, written for engineering but extendable to other professions by replacing the word "engineering", "accreditation" is strictly related to a field-specific QA approach, in which the aims and contents of the educational programmes are specified, and combines together - as already hinted - assurance of "academic quality" and of "professional relevance". Therefore, it can neither be simply qualified as "academic accreditation" nor, on the other hand, as "professional accreditation", because "academic education" may be not sufficient to be "licensed" for a profession (e.g., in several countries to be qualified as "engineer" a graduate of an accredited programme must fulfil further, more or less formalized "professional training" requirements, fixed by professional, not academic, organizations). In order to avoid confusions, "accreditation", defined in this way, can be referred to as "pre-professional accreditation".

It can be maintained that, although the word was not used, the practice of "accrediting" HEI programmes as the standard entry route for a profession was started in the 1800s by the Professional "Chartered" Institutions in the UK; while in France, a law of 1934 introduced the "habilitation" (now translated "accreditation") for engineering schools and degrees, awarded by the "Commission des Titres d'Ingénieur" (CTI) and a prerequisite for the use of the title "Dipl. Ingénieur".

Hence, "pre-professional accreditation" is particularly relevant in engineering. However, my feeling is that of its relationship (and strict interdependence) with the QA of engineering

education have not been yet studied in detail by QA "specialists", and that not all consequent problems have been solved.

In any case, the situation today is much better than few years ago, when engineering programmes of British Universities had to undergo two separate processes (largely duplicates) for quality assessment by the National QA Agency and "pre-professional accreditation" by the relevant Professional Institutions. However, very recently in France the CTI had some difficulties to re-affirm the peculiarity of engineering education and its traditional "habilitation" versus the French newly established QA Agency AÉRES, before CTI and AÉRES reached a substantial agreement.

A recent achievement along the line of "pre-professional accreditation" is the EUR-ACE® system for the "European accreditation of engineering programmes" at the Bachelor and Master levels, envisaged by the EU-supported "EUR-ACE" project (2004-2006) and run by the "European Network for the Accreditation of Engineering Education" (ENAE). "EUR-ACE" is a decentralized Europe-based accreditation system of educational programmes as entry route to the engineering profession ("pre-professional accreditation"): a common quality label (EUR-ACE® label) is awarded to programmes that satisfy a common basic set of standards ("EUR-ACE Framework Standards for the Accreditation of Engineering Programmes") [5] and are accredited by an Agency fulfilling appropriate Quality Assurance prescriptions, in particular the already quoted "European Standards and Guidelines for Quality Assurance in Higher Education" (ESG). ENAE, the "European Network for Accreditation of Engineering Education", founded in 2006 at the successful conclusion of the "EUR-ACE" project, has registered the EUR-ACE® trademark and authorizes qualified Agencies to award the EUR-ACE® label.

The EUR-ACE system obviously follows the "programme approach" to QA and the ENAE

“General Policy”[6] clearly states:

“ENAAE strongly supports a field-specific approach and programme accreditation, considering it essential to fulfil the need of aligning the goals of educational programmes with the expectations of the relevant stakeholders and ensuring their relevance for the labour market.” *and also that:*

“Programme accreditation does not exclude institutional accreditation: on the contrary, it may become easier if an overall system of QA authorizes only quality HE Institutions to deliver academic degrees.”

The *EUR-ACE Framework Standards* identify 21 “programme outcomes” (or “learning outcomes”) for First Cycle degrees and 23 for Second Cycle degrees, and provide a common reference framework serving as the basis for the award of the common European EUR-ACE® quality label: a framework flexible enough to accommodate national differences and even different “profiles”.

(Do not equivocate: the term “Standards” refers to the set of outcomes to be satisfied, and does not imply any “standardization” of the national educational systems, that in the “Bologna” spirit must be “harmonized” and made “transparent”, not “uniform”. Indeed, Europe is a continent of many cultures, whose diversity is valued as a great asset.)

Thus, the EUR-ACE accreditation system is essentially a bottom-up system aiming at a “European Recognition of National Accreditations”: national (or possibly regional) agencies accredit the educational programmes, and ENAAE authorizes (“meta-accredits”) them to add the EUR-ACE® label to their accreditation, after checking that their procedures and requirements satisfy the EUR-ACE Framework Standards (hence the ESG). Thus, the authority for accrediting remains with national bodies, but by agreeing a pan-European meta-framework there is the opportunity to build up cross-border recognition. The ultimate objective of the EUR-

ACE system should be a multi-lateral mutual recognition agreement of engineering degrees, but a number of operative and legal obstacles must still be overcome before this objective can be reached.

Note that, in accord with the *EUR-ACE Framework Standards* and the *European Qualification Framework*[7], the EUR-ACE® label distinguishes between First-Cycle (FC) and Second-Cycle (SC) degrees (sometimes referred to as “Bachelor” and “Master” degrees in engineering). The SC label is awarded also to degrees obtained via “Integrated Programmes” (i.e. “long-cycle” programmes leading directly to a Second-Cycle degree). Consequently, the EUR-ACE-authorization (“meta-accreditation”) specifies if the Agency is authorized to deliver FC and/or SC labels. Each EUR-ACE label is awarded to a specific programme by means of a certificate signed by the ENAAE President and by an official of the Accrediting Agency. The graduates of an EUR-ACE-accredited programme can define themselves as either “EUR-ACE® Bachelor” or “EUR-ACE® Master”, respectively if they have obtained a First-Cycle or Second-Cycle degree.

EUR-ACE is currently implemented by seven Agencies based in seven countries throughout the European Higher Education Area, namely:

- CTI (Commission des Titres d’ Ingénieur), France;
- ASIIN (Accreditation Agency for Study Programs in Engineering, Informatics, Natural Sciences and Mathematics), Germany;
- Engineers Ireland;
- Ordem dos Engenheiros, Portugal;
- RAEE (Russian Association for Engineering Education);
- Engineering Council, United Kingdom;
- MÜDEK (Association for Evaluation and

Accreditation of Engineering Programs), Turkey.

The award of EUR-ACE® labels started in 2007: approximately 1000 labels had been awarded by the end of 2011, some even outside the home countries of the seven Agencies.

EUR-ACE has been quoted by the European Commission as an example of good practice in its 2009 *“Report on progress in quality assurance in higher education”* [8] and in the publication *“The EU contribution to the European Higher Education Area”* [9], issued in the occasion of the 2010 “Bologna Anniversary Conference”.

Note that, at least for the time being, the EUR-ACE® labels are limited to First-Cycle and Second-Cycle engineering degrees, but ENAEE is monitoring the possibility and opportunity of accrediting other engineering programmes, including Third-Cycle (Doctoral) and Continuing Education programmes.

Up to now, ENAEE has received applications to be authorized to award EUR-ACE® labels by six more bodies, namely:

- NVAO (Accreditation Organisation of Netherlands and Flanders);
- ARACIS, QA Agency, Romania;
- SKVC, QA Agency, Lithuania;
- OAQ, QA Agency, Switzerland;
- KAUT, Accreditation Committee for Technical HE Institutions, Poland;
- QUACING (Agenzia per la certificazione della qualità e l’accreditamento EUR-ACE dei corsi di studio in ingegneria), Italy.

These applications are now undergoing the process of evaluation by ENAEE, that involves consideration of submitted documentation and site visits to verify compliance and actual application of the Standards: it is hoped that within a few months most of, if not all, these Agencies will be able to join the EUR-ACE system.

Moreover:

- CTI has signed an agreement with AEQES (the evaluation agency for the HEIs of the French Community of Belgium) that will allow CTI to accredit and award EUR-ACE® labels to French-language Belgian HEIs (as already done for programmes of the bi-lingual Belgian Military Academy, Brussels),
- FINHEEC, the “Finnish Higher Education Evaluation Council”, is studying, with the collaboration of “mentors” nominated by ENAEE, an internal structure aimed at the EUR-ACE accreditation of engineering programmes.

EUR-ACE is arising great interest in other countries too (e.g. Austria, Spain, Denmark, Hungary, ...): thus, the perspectives to make it a truly pan-European system look good.

Besides EUR-ACE, several other organizations and initiatives testify the growing interest of HE circles and stakeholders towards “field-specific” approaches to QA and accreditation. To quote just a few:

- “TechnoTN”, the “Archipelago of Thematic Networks in the fields of Sciences and Technology”, is an example of positive collaborations and exchanges of experience within and between subject- and branch-specific networks and associations. Between 2004 and 2007, four “TechnoTN Fora” had been organized; the 2012 Forum has taken place in Antwerp in May 2012.
- A “Joint Statement of the European Networks for the Accreditation of Chemistry-, Engineering-, Informatics- and Medical Study Programmes” was submitted to the 2007 HE Ministers’ Conference, held in London.
- A Conference “Defining Quality - The Relevance of Field-specific Approaches to Quality Assurance in Higher Education” was held in November 2009 in Bonn, organized by ASIIN and sponsored by ENAEE and a number of other networks.

- The “International Network of Quality Assurance Agencies in Higher Education” (INQAAHE) has promoted a series of meetings of leaders of European disciplinary networks and of professional and specialized accreditors.
- The INQAAHE initiative has led to the foundation in November 2011 of the “European Alliance for Subject-Specific and Professional Accreditation and Quality Assurance” (EASPA), the European analogous of the older American “Association of Specialized and Professional Accreditors” (ASPA). The first EASPA General Assembly has been held in conjunction with the 2012 TechnoTN Forum in Antwerp.

I find, therefore, timely and appropriate, to attach to this paper as Annex 1 the “Düsseldorf declaration”, that EASPA has presented to the Bucharest HE Ministers’ Conference (26-27 April 2012), and defines EASPA’s mission.

References

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- [5] EUR-ACE® Framework Standards; European Network for Accreditation of Engineering Education (ENAAEE), 2009; www.enaee.eu
- [6] ENAAEE “General Policy Statement”; European Network for Accreditation of Engineering Education (ENAAEE), 2008; www.enaee.eu
- [7] A Framework for Qualifications of the European Higher Education Area (QF-EHEA), Bologna Working Group on Qualifications Frameworks, 2005; www.ond.vlaanderen.be/hogeronderwijs/bologna/documents/;
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- [9] European Commission: *The EU contribution to the European Higher Education Area*; Luxembourg, Publication Office of the European Union, ISBN 978-92-79-15103-3; doi: 102766/63140, http://ec.europa.eu/education/pub/pdf/higher/ehea_en.pdf

ANNEX 1

Düsseldorf Declaration of the European Alliance for Subject-Specific and Professional Accreditation and Quality Assurance (EASPA)

The European Alliance for Subject-Specific and Professional Accreditation and Quality Assurance constitutes a pan-European platform of quality assurance in Higher Education that

comprises the European Association for Public Administration Accreditation, the European Association of Conservatoires, the European Chemistry Thematic Network Association, the European Countries Biology Association, the European Federation of Geologists, the European Network for Accreditation of Engineering Education, the European Physical Society, the European Quality Assurance Network for Informatics Education as well as the International Food Association. EASPA unites comprehensive European field specific networks as partners in their common goal to maintain and develop European-wide disciplinary learning outcomes, competence profiles and qualification frameworks as well as corresponding quality assurance tools thereby making an important contribution towards the development and implementation of academic and professional mobility within the European Higher Education Area.

Aiming at:

- Securing and improving the quality of higher education within the EHEA;
- Refining the Dublin Descriptors and adjusting them to the necessities of the various disciplines and study cultures thereby adding a content dimension to the structural elements of the Bologna process
- Facilitating trans-national recognition of academic qualifications through a recognised quality label in their respective discipline and facilitating recognition of academic qualifications by the competent authorities;
- Protecting consumers against false information and low-quality university degrees and other qualifications;
- Advancing good practices and knowledge in the field of quality assurance, and communicating the value of accreditation as a means of enhancing educational and professional quality

the members represented in EASPA have

undertaken the development of subject-specific criteria and procedural guidelines, European learning outcomes as well as competence profiles and qualifications based on which academic and professional mobility in the respective discipline may be facilitated.

The resulting quality criteria are complementary to the outcomes defined in the Framework for Qualifications in the EHEA, adopted in Bergen 2005, and the European Qualifications Framework for Lifelong Learning, adopted by European Parliament and Council in 2008. In line with the approach established by the EU-funded Tuning project for the design, implementation, and evaluation of degree programmes, they reflect the state of the art in their respective disciplines and the competences graduates must have acquired in order to be able to take up their chosen profession. The development and improvement of these quality criteria involves intensive consultation with experts from academia, scientific societies industry as well as other relevant stakeholders. Thus it is assured that these criteria do not only reflect the state of the art from an expert's point of view but also meet with the widest possible acceptance without compromising the quality requirements.

The undersigning European networks state that their work not only provides criteria for the accreditation or quality evaluation of transnational programmes and highly international disciplines for which appropriate criteria did previously not exist, but contributes to the harmonisation of the European Higher Education Area by providing a sound basis for the mutual recognition of qualifications awarded by institutions of higher education throughout the EHEA.

It is in this spirit:

based on the Bologna Declaration and the Communiqué of the Conference of European Ministers Responsible for Higher Education, Leuven and Louvain-la-Neuve, April 2009, accentuating the continuing development of

learning outcomes and international reference points for a growing number of subject areas by academics, in close cooperation with student and employer representatives, and encouraged by the acknowledgement of the positive role of European networks and quality labels for specific subject areas in

- the report "From London to Leuven" (2009) calling for broad involvement of stakeholders in improving work done on links and interaction between the qualifications frameworks and quality assurance and identifying the need of employers for trusting qualifications,
- in the EU Commission Report (2009) quoting the "Eurochemistry seal" and the "EUR-ACE label" as good practice examples and stating the need for further cross-border quality assurance,
- the report "The EU Contribution to the European Higher Education Area" (2010) stating that the Commission supports the development of subject-specific European quality labels

that the representatives of the EASPA hereby submit this Düsseldorf Declaration to the 47 European Ministers of Education for the upcoming Bologna Ministerial Conference in Bucharest in April 2012.

EASPA pledges to support the Ministers in their joint political goal to achieve full-fledged academic and professional mobility in Europe by

- creating European quality standards for other appropriate disciplines and professions;
- further developing the existing criteria and standards based on learning outcomes for

the award of subject-specific accreditation certificates or European quality labels;

- acknowledge the significance of European quality labels complementary to national evaluation and accreditation for the assurance of quality in the European Higher Education Area and for the mobility of holders of academic qualifications;
- calling upon the governments of Bologna signatory states to facilitate the recognition of the European Quality Labels by the relevant national authorities.
- Signed in Düsseldorf, 29 November 2011, by the representatives of
 - the European Association for Public Administration Accreditation (EAPAA)
 - the European Association of Conservatoires (AEC)
 - the European Chemistry Thematic Network Association (ECTNA)
 - the European Countries Biology Association (ECBA)
 - the European Federation of Geologists (EFG)
 - the European Network for the Accreditation of Engineering Education (ENAE)
 - the European Physical Society (EPS)
 - the European Quality Assurance Network for Informatics Education (EQANIE)
 - the ISEKI Food Association (IFA)

