Academic Accreditation And Assessment Processes In Higher Education

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Abstract—As a lead member in the implementation of a program accreditation and assessment, we report the experience of a three-year long set of processes as implemented in a Computer Science Program in a large public University. In order to get recognition and trustworthiness from the community, Higher Education Institutions and programs of study undergo academic accreditation and assessment processes. These latter, while providing a social status, are meant to acknowledge that accredited institutions or programs are implementing, monitoring and closely following recognized and requested quality criteria issued from common good practice duly certified by accrediting bodies. The paper addresses some issues in academic accreditation and assessment in Higher Education (A3-HE) with special emphasis on computer science / engineering and closely-related areas.

Keywords— Academic accreditation, Accreditation bodies, Quality assurance, Accreditation mills, Degree mills, INQAAHE, ABET, CSAB, NCAAA.

I. Introduction

Literally speaking, accreditation means to give credit or pay tribute to someone or something for the achievement of a given prescribed task with an acceptable degree of proficiency. Formally speaking, academic accreditation is a type of official certification based on quality assurance processes under which services and operations of academic institutions or programs are evaluated by an external accrediting body to determine whether prescribed standards are met; in which case, accredited status is granted by the external body. The aim of academic accreditation is both to acknowledge quality and to monitor continuous assessment - for a lifetime. Accreditation bodies are themselves either nominated by government organization or accredited by other external bodies. Academic accreditation and assessment in Higher Education (A3-HE) is a complex lengthy, tedious set of intertwined processes involving people at different levels of responsibility within the community, costly machines, various artifacts, and more often than not, heavy clerk work and expensive resources in terms of time, money in addition to other unquantifiable elements [1]. On the other hand, subjective judgments might interfere with the processes. Indeed, both the internal self-examination undergone by institutions / programs and the external reviewing processes made by recognized accrediting bodies are prone to errors and subjective biases as they are largely based on rules of thumb human judgments – despite the presence of standards. In most countries of the world, academic accreditation processes are conducted by a government organization such as a Ministry of Education / Higher Education. Most academic institutions or programs seeking accreditation are required to conduct a periodical review, at least once in every four to six years, or so, in order to determine transparency, specificity, validity, reliability, consistency, and homogeneity for measuring quality of education and training, and relevancy to type of program and training needed by the community.

All parties concerned by the A3-HE, whether they be students, parents, employers, or members of the community should gain complete confidence that what has been learned by students, the research conducted by faculty, and the services provided are equivalent to good international practice. Accreditation of a program will give an official and public recognition that these standards have been achieved. As a result, accredited qualifications should be unquestionably accepted anywhere in the world.

Our aim is to contribute to a better understanding and a unified view of the processes involved in A3-HE as actually requested by accrediting bodies around the world. A structural grasp of the processes will pave the way to the definition of the main computational technologies destined to the enhancement of the processes involved in A3-HE. A set of computational technologies have been described to address these issues. Emphasis is made on technologies spanning (crude) data, information, refined information including decision support, ultimately leading to the most refined and expensive piece of information, *i.e.*, knowledge and its discovery in large and diversified databases over the Web, based on cloud computing solutions. These technologies have been reported earlier and are constantly integrated within higher system-oriented view of A3-HE [2]. The various possible computational architectures and implementations of these novel technologies suggest a further understanding of the academic processes; hence this paper. This latter is organized as follows. Section 2 gives an overview of A3-HE processes *per se*. Section 3 describes the international concern about A3-HE. In Section 4, special attention is given to A3-HE for

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computing disciplines. Section 5 describes a three-year long exercise undertaken in the accreditation of a Computer Science Program in a large public University. The paper ends with a conclusion summing up the main results and highlighting future improvements.

II. Efforts In A3-HE-related issues

A. World commitment

For many years, A3-HE has been an international concern. Many international networks, involving countries, regions and multinational organizations took form in order to address the issues raised by A3-HE at a global level. These networks have been aggregated, commonly in regions, and usually in the presence of other geo-political mechanisms associating relevant countries.

1) Arab/Islamic world

The Arab Countries as part of international networks have established the Arab Quality Assurance Network for Higher Education (ANQAHE), in operation since 2007. [http://anqahe.kasralainy.com/]. Historically, the Arab / Islamic world is widely recognized as having played a central role in the foundation of much of the world's contributions to nearly all branches of science and philosophy, during at least six centuries. However, this culture has contributed very little during the modern era. As observed in a report published by Thomson Reuters, the data reported show that research in the region still lags significantly on its European and Asian neighbors. The Nobel Laureate in Chemistry, Ahmed Zweil identifies three important essential components that would address the gap in performance for the Middle East; the development of human capital as the first of these. Second, the research environment, strongly supported by universities that are free to pursue their own programs of thought and innovation, should be implemented. Finally, the creation of center of excellence is a must, as a route to development – not only regional partnerships but links to the rest of the world. Although dormant for a while, a new research landscape is slowly appearing in the region. For Iran, 1.7% of its publications in mathematics were ranked in the global 1% most highly-cited; well above global average. For Turkey, 1.5% of its engineering output met the same criterion. Although national average citation impact may lag behind world averages, as for now, there is a growing volume of excellence that will undoubtedly enable further growth of high-quality research capacity [3].

1) Other experiments

The European Commission in Europe or AQAN in the Association of Southeast Asian Nations (ASEAN) or CARICOM in the Caribbean countries are also part of the international networks. The US experience is described in later section in conjunction with the computing discipline. Some important aspects have been reported in relation with the reform of higher education in Europe through the principles of change and modernization present in the Bologna Process. By applying a SWOT analysis (Strengths, Weaknesses, Opportunities, Threats), challenges were identified as to the European higher education system summarized as follows:

- need for qualified professionals,
- certificates' recognition,
- students' mobility,
- university autonomy,
- rapid changes of the economic environment, [4].

Other efforts have been deployed using novel ways for international collaboration. For instance, game-based virtual learning environments have been developed for fostering new teaching and learning approaches, ensuring the worldwide collaboration of students and teachers. Four countries, Finland, Slovenia, Germany and Estonia have been collaborating for a classroom management model that has been set out, outlining teaching and learning methods and assessment for virtual learning environments. In this environment, students may collaborate internationally, benefiting from guidance of international teacher teams [5].

B. International networks for A3-HE

Many international networks have been established. Among the main existing international networks operating in the field of A3-HE, we find the following bodies [6]. All sites have been accessed and are operational, as of April 2011.

- International Network for Quality Assurance Agencies in Higher Education (INQAAHE) 1991, starting with 12 initial founding quality agencies. INQAAHE counts over 200 member agencies and bodies worldwide, as of April 2011.
  http://www.inqaahe.org/index.php
- Africa (AQANet), 2004,
  http://www.aquanet-services.com/
  Africa (AfriQAN), 2007, http://afriqan.aau.org/
- ASEAN Quality Assurance Network (AQAN), 2008, http://www.mqa.gov.my/aqan/
- Nordic Quality Assurance NOQA, 1992, http://www.nokut.no/noqa
- The Central American Quality Assurance System (CSUCA), 1997,
  http://www.hrk.de/de/hrk_international/3819.php
- Francophone Africa: Conseil Africain et Malgache pour l'Enseignement Supérieur (CAMES), 2000
  http://www.lecames.org/index.php
- Latin America and Spain: Red Ibero-Americana de la Calidad del Education Superior (RIACES, 1999/2003, http://www.riaces.net/
- European Network for Quality Assurance in Higher Education, (ENQA) 2000/2004
  http://www.enqa.eu/
- Central and Eastern European Network (CEEN, 2000/2002, http://www.ceenet.org/
- Caribbean Area Network for Quality Assurance in Tertiary Education (CANQATE), 2002/2003, www.canqate.org
- Asia Pacific Quality Network (APQN), 2003, http://www.apqn.org/
- European Consortium for Accreditation in Higher Education (ECA), 2003,
  http://www.ecaconsortium.net/

- Eurasian Education Quality Assurance Network (EAQAN), 2004, http://www.nica.ru/eng/naa/activity/international/networks/ecoko/.

C. Basics of A3-HE

We first begin by explaining the basics of A3-HE irrespective of the country and the accrediting body.

1) A3-HE policies

For institutional accreditation, the first step is that an institution requests an evaluation of some of its programs that have produced at least one graduate. Each program then conducts an internal evaluation and completes a self-examination process. The self-study describes the actual status of the institution / program and describes to what extent students, curriculum, faculty, administration, facilities, and institutional support meet the established criteria.

In some countries, *e.g.* the United States, accreditation is a peer-review, non-governmental set of processes that assures the quality of the postsecondary education [7]. Educational institutions or programs undergo this review periodically to determine if requested criteria or standards are being closely followed.

In all other countries, accreditation is neither necessarily voluntary nor non-governmental. The United Nations Educational, Scientific, and Cultural Organization (http://www.unesco.org) gives the required information on the world's postsecondary education systems and their quality assurance mechanisms. In any case A3-HE is not to be confused with ranking systems such as the Academic Ranking of world Universities (ARWU, http://www.arwu.org), or the Times Higher Education (THE, www.timeshighereducation.co.uk/), for instance.

2) Types of A3-HE

Three types of A3-HE can be identified: institutional, specialized or program-based, and hybrid.

(i) Institutional accreditation

Institutional accreditation evaluates overall institutional quality. One form of institutional accreditation is regional / national / international accreditation of colleges and universities.

(ii) Specialized or program accreditation

Specialized or program accreditation examines specific programs of study, *e.g.,* Bachelor of Science in Computer Science, rather than an institution as a whole, *e.g.* University or College. This type of accreditation is granted to specific programs at specific levels such as undergraduate, postgraduate, professional, or other specialized academic training. Architecture, nursing, law, medicine, and engineering programs are often evaluated through program accreditation. In this case, A3-HE is granted by specialized bodies, usually incorporating professional societies. For instance, for computing disciplines, there is a strong interaction between the Accreditation Board for Engineering and Technology (ABET) (http://www.abet.org), on the one hand, and leading professional societies such as the Institute of Electrical and Electronics Engineers (IEEE) (http://www.ieee.org) and the Association of Computing Machinery (ACM http://www.acm.org), on the other hand.

(iii) Hybrid accreditation

Hybrid accreditation examines both types of accreditation expanded above. In this case, programs are accredited on the condition that institutional accreditation is initially granted by the same accrediting body. For example, the National Commission for Academic Accreditation and Assessment (NCAAA) (http://www.ncaaa.org.sa), based in Riyadh, Saudi Arabia, grants accreditation for both institutions and programs.

D. A3-HE generic processes

1) Documented evidence

The key to successful academic accreditation and assessment is documented evidence. Although difficult to fully implement in practice, this documented evidence should obey the following procedure:
- collect data from different and diversified sources;
- use multiple assessments to create as many data points as possible;
- evaluate both alumni and employer satisfaction once students graduate;
- undertake periodic program reviews with the involvement of external and independent reviewers.

The previous steps roughly describe a whole culture to be instilled and installed in the institution / program. For this accreditation and assessment culture to be effective, it is important to make sure that:
- faculty have a central role in planning and evaluating programs;
- standards clearly align with each other;
- standards clearly align with accreditation requirements; and

all implemented measures are internally consistent.

2) A3-HE – The test in itself

Any A3-HE test, whether institutional or addressing a specific program, roughly follows the same steps, as expanded below.

(i) Self-examination

Once eligibility requirements are fulfilled (*e.g.* one graduate at least for a program), an institution or program has to produce its own self-evaluation. This latter consists in describing the actual settings, corroborated by documented and measurable evidence – neither personal, biased opinions nor wishful thinking.

(ii) Evaluation though team visit

Team evaluators from the accrediting body pay a visit to the institution/program. The team is composed of at least one chairperson and one or more program evaluators. Team members are in general volunteers from academe, government, and industry, as well as private professionals. While on-campus, the evaluation team reviews various students' documents like course materials, student projects, sample assignments, exams, and any other relevant information. Other documents such as written policies and regulations, meetings minutes might also be consulted. The team undertakes interviews with students, faculty, administrators, perhaps employers, alumni, and any other party whose contribution is judged important by the team. The main purpose of the visit is to investigate whether the criteria are met and tackles any questions raised by the self-examination.

(iii) Result of the visit

Following its campus visit, the team provides the institution/program with a written report of the evaluation. The information the institution / program receives identifies strengths, concerns, weaknesses, deficiencies, and recommendations for improvements. This allows the program to correct any misrepresentations or errors of fact, and to address any shortcomings in a timely manner.

(iv) Final decision

The final evaluation report is presented by the evaluation team to the accrediting body. Based on the findings of the report, the accrediting body members decide on the final action, and the institution / program is officially notified.

(v) After accreditation

Accreditation is granted for a given period of time, usually in the range of four to six years. To renew accreditation, the institution / program must request another evaluation which implies that a continuous assessment is to be followed.

E. Motivations for implementing A3-HE

There are many reasons that can be invoked for the implementation of A3-HE. These can be summarized as follows.

1) Competition-related issues

The first motivation is competition-based.

(i) From the students/parents perspective:

- Experience ease in transferring credits from one school to another.
- Gain greater access to competition-based loans, scholarships, postsecondary education and specialized programs that require students attend accredited institutions.
- Benefit from their institution or educational system's commitment to raising student performance and accountability.

(ii) From the institution/program perspective:

- Gain a reputation in the community ensuring authority, trustworthiness, and academic reference.
- Stay competitive in a rapidly-changing academic and professional landscapes.

2) The threat of degree and accreditation mills

In many higher education and training institutions around the world, we may encounter dubious providers of educational offerings or operations that offer certificates and degrees that may simply be considered as fake. These are usually referred to as "degree mills". At a higher level, we may also encounter "accreditation mills", *i.e.* bogus A3-HE bodies that may offer a certification of quality to institutions with no proper basis. Fake accreditation from an accreditation mill misleads the community as a whole about the quality of an institution.

Degree mills and accreditation mills have disastrous impact on the community because they are both misleading and harmful to all parties – students, parents, institutions, programs, and the community. In many countries, degrees and certificates from mills are not acknowledged by other institutions in case students seek to transfer or go to graduate schools. Employers do not recruit this type of graduates and do not acknowledge these degrees and certificates when providing tuition assistance for continuing education. In the presence of degree mills and accreditation mills, the community may spend much money but, as a counterpart, receives neither an acceptable education nor a recognized credential for the end-products – the students. It is therefore a must for the community to identify both degree and accreditation mills and take action against them. Some issues concerning these mills have been reported by the Council for Higher Education Accreditation (CHEA). [http://www.chea.org/degreemills/].

III. International A3-HE bodies

Within the multinational networks described above, there exist accrediting bodies operating nationally and other internationally. We will stress only those we think are prominent and are close to our computing discipline settings.

A. Business Education – AACSB/EQUIS

1) AACSB

The Association to Advance Collegiate and Schools of Business (AACSB) is an A3-HE agency for Bachelor, Master and Doctoral degree programs in business administration and accounting. AACSB accreditation requires the specification of learning goals and demonstration of their achievement for key general, management-specific, and/or appropriate discipline-specific. AACSB is a mechanism for international consistency and comparison. As of December 2010, 607 member institutions hold AACSB Accreditation. Overall, 38 countries are represented by AACSB-accredited schools. Among the accredited schools:

- 50 institutions have undergraduate programs only (8% of accredited members).
- 28 institutions have master's and doctoral programs only (5% of accredited members).
- 175 institutions have AACSB's additional accounting accreditation (28% of accredited members). [http://www.aacsb.edu]

2) EQUIS

The European Quality Improvement System (EQUIS) is a leading international A3-HE in management and business administration. EQUIS is a member of the European Foundation for Management Development (EMFD), a global organisation devoted to the continuous improvement of management development (http://www.efmd.org/). Operating internationally like AACSB, EQUIS grants accreditation for first degree in business and management, MBA and PhD. In 2010, EQUIS has accredited two additional institutions in China and one in Thailand, and granted re-accreditation to ten other institutions. Overall, EQUIS has accredited 129 schools in 36 countries.

[http://www.efmd.org/index.php/accreditation-/equis]

B. Architecture Education - RIBA/NAAB

AACSB and EQUIS are not the only ones operating at international level. Other examples of such agencies is the UK-based Royal Institute of British Architects (RIBA) http://www.architecture.com/ and the US-based National Architectural Accrediting Board (NAAB) http://www.naab.org/

IV. Computing Disciplines Bodies

Perhaps as a result of publicity reported in news media about software disasters, some countries and state legislatures have considered regulating the practice of computing disciplines and software engineering, in particular. Many professionals believe that accreditation in higher education is inevitable to curb forthcoming software catastrophes. The accreditation will ease further (personal) certification of graduates. The issues associated with A3-HE of computer science/software engineers are, or at least should be, a high-priority concern to the computer science/software engineering community. Despite the fact that the ACM/IEEE2008 Curriculum [8] is clear about the content of a typical computer science course, precisely delineating 14 knowledge areas, the debate has been going on for years as to the universally accepted body of knowledge for software engineering on which to base A3-HE, thus entailing a difficult implementation [9]. On the other hand, efforts have made in order to implement outcomes-based education (OBE) approach with the involvement of stakeholders, selected among engineering based companies and organizations, particularly from the potential employers of future graduates. In this approach, each objective or outcome statement is broken down into attributes that form the full statement. Each attribute is to be evaluated based on the five-level Likert scale. The result of the survey based on 131 inputs from the industrial stakeholder is presented and is able to highlight statements which need to be reviewed or reformulated [10].

A. ABET

1) ABET worldwide activities

Like the accrediting bodies AACSB/EQUIS, RIBA/NAAB, the Accreditation Board for Engineering and Technology (ABET) is one of the US-based agencies operating internationally. ABET, Inc, (or ABET for short) is a recognized A3-HE body in applied science, computing, engineering, and technology. ABET draws its recognition from the Council for Higher Education Accreditation (CHEA). In the US, ABET has provided quality assurance in higher education for over 75 years. To date, ABET accredits over 3,100 programs at more than 600 colleges and universities worldwide [http://www.abet.org].

2) ABET Structure

As of April 2011, ABET represents a federation of 29 members and one associate member of professional and technical societies. Among these societies, we find IEEE (http://www.ieee.org) and CSAB (Computing Sciences Accreditation Board, Inc., http://www.csab.org). Most member societies within ABET have curricular responsibilities. They recruit and assist in training qualified Program Evaluators who, along with Team Chairs, comprise the teams assigned to accreditation visits. ABET member societies also nominate individuals to the four ABET Accreditation Commissions representing Applied Science, Computing, Engineering, and Technology. Member societies also appoint individuals to the ABET Board of Directors.

B. CSAB

1) CSAB Structure

Computing Sciences Accreditation Board, Inc. (CSAB) is a US-based non-profit professional organization, handling quality of education in computing disciplines. CSAB is the lead society within ABET for accreditation of programs in computer science, information systems, software engineering, and information technology, and is a cooperating society for accreditation of computer engineering, biological engineering, and information engineering technology. The Association for Computing Machinery (ACM, http://www.acm.org) and the IEEE Computer Society (IEEE-CS http://www.computer.org/portal/web/guest/home) are the member societies of CSAB. The Association for Information Systems (AIS) was a member society between 2002 and September 2009. For a brief history of CSAB refer to [11]. http://home.aisnet.org/associations/7499/files/Index_Markup.cfm.

*2) CSAB Objective*s

CSAB has responsibility for selection and training of Program Evaluators and for the development of accreditation criteria. Accreditation activities are conducted by one of the four commissions within ABET namely the Computing Accreditation Commission (CAC). Within ABET, the CAC is responsible for the accreditation of programs in computer science, information systems, and information technology, while the Engineering Accreditation Commission (EAC) is responsible for the accreditation of programs in software engineering and computer engineering (http://www.csab.org).

C. CSAB/ABET (CAC) Criteria

1) General criteria

General Criteria apply to all programs accredited by one of the four ABET commissions cited above. Each program accredited by an ABET commission must satisfy every Criterion that is in the General Criteria for that commission. These criteria are effective for evaluations during the 2011-2012 Accreditation Cycle. For more details refer to [12] and to ABET Web site. For the present Accreditation Cycle, ABET General Criteria are:

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

Criterion 8. Institutional Support

2) Program criteria for computer science (CS)

According to CAC, programs must show that they satisfy all of the specific Program Criteria implied by the program title. Any overlapping requirements need be satisfied only once. The Program Criteria for computer science provide computer-specific accreditation criteria. The Program Criteria for computer science are:

Criterion 3: Student Outcomes

Irrespective of the accrediting body, *Student Outcomes* have represented one of the most important facets in A3-HE [13], [14], [15]. As far as ABET/CSAB/CAC are concerned, the program must enable students to attain, by the time of graduation the following set of requirements:

- An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.
- An ability to apply design and development principles in the construction of software systems of varying complexity.

Criterion 5: Curriculum

Students must have the following amounts of course work or equivalent educational experience:

(a) Computer science coverage

One and one-third years must include:

- Fundamentals: Coverage of the fundamentals of algorithms, data structures, software design, concepts of programming languages and computer organization and architecture.
- Languages and Systems: An exposure to a variety of programming languages and systems.
- Programming proficiency: Proficiency in at least one higher-level language.
- Advanced material: Advanced course work that builds on the fundamental course work to provide depth.

(b) Science and mathematics

One year of mathematics and science:

- Mathematics: At least one half year that must include discrete mathematics. The additional mathematics might consist of courses in areas such as calculus, linear algebra, numerical methods, probability, statistics, number theory, geometry, or symbolic logic.
- Science: A science training that develops an understanding of the scientific method and provides students with an opportunity to apply this mode of inquiry in courses for science or engineering majors that provide some exposure to laboratory work.

Criterion 6: Faculty

Some full-time faculty members must have a Ph.D. in computer science.

3) Program criteria for information systems (IS) and information technology (IT)

Both information systems (IS) and information technology (IT) programs rely on criteria similar to those for computer science described above. They are both centered on the criteria of *Students Outcomes*, *Curriculum*, and *Faculty* but with relevant corresponding contents and faculty profile.

4) ABET-(CSAB-CAC)/ACM-IEEE interaction

ACM and IEEE, as leading professional societies within ABET, have developed a curriculum to be implemented in Higher Education Programs. As far as Computer Science is concerned, the latest version is the ACM/IEEE2008 Curriculum - an amendment of its 2001 version [16]. There are corresponding curricula in Information Technology and Computer Engineering. The body of knowledge of the ACM/IEEE2008 Curriculum for Computer Science is based on the identification of 14 knowledge areas; each one being divided into sub-areas. Table 1 represents a summary of this body of knowledge. The number of sub-areas is 147 and the number of total core contact hours (not credit hours) is 293.

Body of Knowledge	*Sub-areas*	*Core hours*	*Body of Knowledge*	*Sub-areas*	*Core hours*
DS: Discrete Structures	6	43	***HC***: Human-Computer Interaction	10	8
PF: Programming Fundamentals	8	47	***GV***: Graphics and Visual Computing	13	3
AL: Algorithms and Complexity	11	31	***IS***: Intelligent Systems	11	10
AR: Architecture and Organization	10	36	***IM***: Information Management	15	11
OS: Operating Systems	14	18	***SP***: Social and Professional Issues	11	16
NC: Net-Centric Computing	9	18	***SE***: Software Engineering	15	31
PL: Programming Languages	11	21	***CN***: Computational Science	3	0
Total				***147***	***293***

Table 1 ACM/IEEE2008 CS curriculum summary

V. Example of A3-HE exercise

This Section is devoted to the description of an A3-HE exercise undertaken as a rehearsal for the accreditation of a Computer Science program at one major Saudi University under the auspices of the National Commission for Academic Accreditation and Assessment (NCAAA).

A. Example of a national body NCAAA

1) NCAAA Objectives

The National Commission for Academic Accreditation and Assessment (NCAAA), based in Riyadh, Saudi Arabia, is a governmental body acting under the auspices of the Higher Council of Education. NCAAA http://www.ncaaa.org.sa/english/adefault.aspx) is vested with the responsibility for determining standards and criteria for academic accreditation and assessment and for accrediting both post secondary institutions and the programs they offer. The Commission encourages, supports and evaluates quality assurance processes of post secondary institutions to ensure that quality of learning and management of institutions are equivalent to the highest international standards. These high standards and levels of achievement are aimed to be widely recognized both nationally and worldwide. The only exception is for military education which is administered under different arrangements.

2) NCAAA Standards

NCAAA accreditation is based the following 11 standards for both institutions and programs:

S1. Mission and Objectives

S2. Governance and Administration

S3. Management of Quality Assurance and Improvement

S4. Learning and Teaching

S5. Student Administration and Support Services

S6. Learning Resources

S7. Facilities and Equipment

S8. Financial Planning and Management

S9. Faculty and Staff Employment Processes

S10. Research

S11. Institutional Relationships with the Community

B. ABET/NCAAA comparison

In Table 2, as a summary, we give a brief comparison between ABET and NCAAA with the projection of all Standards/Criteria on three main activities related to *Learning/Teaching*, *Research*, and *Community Involvement*. Special emphasis is put on CSAB/CAC component of ABET. The columns in Table 2, describing the ABET/CSAB, indicate the Criterion Number and whether this criterion is a specific one *i.e.* whether it is named as such. For example, *Learning and Teaching* is not a specific criterion in ABET/CSAB, since it is spread on criteria 3 (*Student Outcomes*), 4 (*Continuous Improvement*), and 5 (*Curriculum*), while *Learning and Teaching* is a specific one for NCAAA expressed in Standard 4, explicitly termed as such.

Activity	ABET/CSAB			NCAAA		
	Criteri	Specific Criterion?		Std #	Specific Standard?	
		YES	N		Y	N
Learning and Teaching	3,4,5		√	4	√	
Research	6,7,8		√	10	√	
Community	4,5,8		√	2,9		√
				11	√	
Mission / Governance	2	√		1,2		√
	4,8		√	3,8,9		√

Table 2 – ABET and NCAAA components

C. *Practical steps for A3-HE*

1) The preparation

In the Academic year 2007-2008, the University took the decision to implement the accreditation policy under the guidance of the NCAAA. At the outset, and as for now, six pilot departments have been selected to be part of this process; Computer Science Department at the Computer College being one of them. The strategy followed is that proposed by the NCAAA. The objective is to improve the performance of instructors, administrators and leaders within the Department. The main committees and main documents are identified; the most important document being the *Self Study Report*.

2) The Panel visit

In the period 31st October – 4th November 2009, the Department was visited by the Panel, acting on behalf of the NCAAA and composed of three members from recognized academic institutions. In NCAAA jargon, the Panel main objective as a whole is to make initial commendations, recommendations and suggestions, based on the documented evidence expanded in at least four basic documents, namely, the *Self Study Report* of the Department, the *Program Specification Report*, the *Annual Report* and the *Self Evaluation Scales*. Specifically, the objective of the visit is to have on-sight infrastructure evidence and conduct free and confidential *viva voce* interviews with all relevant parties such as faculty, administrative personnel, students, alumni, employers, *inter alia*.

3) Feedback from the Panel

The Panel's report is a written document that consists of a detailed appreciation of the degree to which the standards of NCAAA are followed within the Department regarding accreditation. The Panel impartially describes the extent of applicability of the eleven NCAAA Standards within the Department. The main guides for the Panel are the NCAAA documents such as the *Standards for Quality Assurance and Accreditation of Higher Education Program* [17], and the *National Qualifications Framework for the Kingdom of Saudi Arabia* [18], and the *Handbook for Quality Assurance and Accreditation* [19]. As understood from the NCAAA policies and the external examiners preliminary report, the expected response from the Department should only indicate whether the report describes the actual state of affairs within the Department offering the program. In case of any discrepancy, evidence should be provided. The requested feedback from the Department is to be used by the Panel in the writing of the final report, to be sent back again to the Department and be considered as a point of departure in the forthcoming true process of accreditation, knowing that all the preceding procedures undertaken so far were only a training exercises. As soon as the final report is received from the Panel, the Department will take in charge the true accreditation process. The report contains:

- A number of commendations, *i.e.* positive elements that have to be maintained.
- A number of recommendations, *i.e.* elements that have to be corrected *prior* to the obtainment of accreditation.
- A number of suggestions, *i.e.* optional elements to implement for the improvement of the Program.

4) Response from the Department

The Department indentified four levels of responsibility. It is obvious that any Program, such as Bachelor of Science in Computer Science, delivered within a Higher Education Institution, is bound to have interaction with the Institution in which it is delivered. The report addresses the overall issue of accreditation, and, as such, implicitly deals with many levels of responsibility. In addition to its own responsibility, the Department suggests three additional levels of responsibility namely, the College, the University and finally the Ministry of Higher Education. The Department highly recommends that the final Panel's report be circulated to all these decision-making levels. The Department understands very well that there will be no accreditation whatsoever if the recommendations are not met, *i.e.* if at least one of the decision-making level fails to respond adequately and in due course. The Department is responsible for achieving all requirements that are within its sphere of intervention but it is very clear that the Department cannot guarantee that all parts will be as proactive as needed. Will non-nationals leadership be tolerated? Will multi-year contracts be made possible for non-nationals? Are recruitment/renewal processes going to change in order to follow a more institutionalized form? Are teaching and community involvement workload going to be balanced with active research workload for faculty? Due to constraints beyond its control, the Department does not have any substantial evidence as to the addressability of any of these issues at any level in the foreseeable future.

5) Department accountability

As stated in its objectives, the Department is vested with statutory authority for planning, formulating and the maintaining norms and standards, for eventual funding of priority areas, monitoring and evaluating, and finally for ensuring the coordinated and integrated development of computer science education as specified in the program. Mandatory periodic evaluation are to be carried out in conjunction with the NCAAA. The program administration is therefore accountable to senior management within the College and the University and flexible enough to meet the requirements of the program. The Department does not have any substantial grievances as to the Panel's report contents. Moreover, the Department strives to inculcate the required professional values to all parties in conjunction with its mission, vision and set of values [20]. As it stands, the report has therefore been accepted as a new point of departure for the accreditation process, now completed and awaiting final decision from the accrediting body.

VI. Conclusion

Based on many years practical and hands-on experience, we have described the main academic processes involved in academic accreditation and assessment in Higher Education (A3-HE). The prominent world accrediting consortia have been reported. As an example of accrediting process, emphasis has been made on the computing discipline and on its corresponding accrediting bodies. The intended competences to be achieved by graduates are competences of working in the national, regional and global academic and professional computing environments. We have pointed to national and international bodies that help on investigating new organizational solutions which meet educational changes so as to ensure national and international collaboration of students and teachers.

It is only after academic processes have been defined that it became possible to present the computational technologies for enhancing them. Although technological implementations are necessary, the A3-HE excellence is too complex to be addressed by computerized systems alone. As a result, better academic processes are to be searched for and implemented.

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References:

[1] Westerheijden, D. F., B. Stensaker, M. João Rosa (Editors) "*Quality assurance in higher education: trends in regulation, translation and transformation*", Springer, 2007.

[2] Hamdi-Cherif, A., "A computational framework for academic accreditation and assessment in higher education (A3-HE) – Part 2 technologies", Invited Conference Paper In: *Recent Advances in Artificial Intelligence, Knowledge Engineering and Database (AIKED'11)* , Cambridge, UK, February 22-25, 2011, pp. 411-418, Print version ISSN: 1792-8117, ISBN: 978-960-474-273-8, http://www.worldses.org/online/2011.htm.

[3] Adams, J., C, King, D. Pendlebury, D. Hook, J. Wildson, Foreword by A. Zweil, *"Global Research Report, Middle East Report, Exploring the Changing Landscape of Arabian, Persian and Turkish Research"*, Published by Evidence, 103 Clarendon Road, Leeds LS2 9DF, UK, Thomson Reuters, 2011, Email: scientific.enquiries.evidence@thomson.com, ISBN: 1–904431–27–5. (Global Research Reports from Thomson Reuters are available at http://researchanalytics.thomsonreuters.com/grr/)

[4] Duze, D-M, C.S. Duse, "Engineering education in a highly globalised world", *5th WSEAS / IASME International Conference on Engineering Education, (EE'08)*, Heraklion, Greece, July 22-24, pp. 206-210, 2008.

[5] Starcic, A.I., "Introducing game-based virtual learning environment: managing educational change in higher education", *WSEAS Transactions on Advances in Engineering Education*, 7(5):498-507, July 2008.

[6] INQAAHE "Graduate Qualification in Quality Assurance", INQAAHE, The Hague 2009.

[7] Ewell, P.T., "US accreditation and the future of quality assurance", Council on Higher Education Accreditation (CHEA), Washington DC, 2008.

[8] Association for Computing Machinery (ACM) "Computer Science Curriculum 2008: An Interim Revision of CS 2001", 15 November 2008, downloadable from http://www.acm.org

[9] Mead, N. R., A. J. Turner "Current accreditation, certification, and licensure activities related to software engineering", *Annals of Soft. Eng. - Special Issue on Soft. Eng. Education*, 6(1-4), April 1999.

[10] Abdullah, S. *et al*., 'Implementing continual review of program educational objectives and outcomes for OBE curriculum based on stakeholders' input", *Proceedings of the 7th WSEAS International Conference on Education and Educational Technology, (EDU'08),* pp.218-223.

[11] Engel, G., J. Impagliazzo, P. LaMalva "A brief history of the computing sciences accreditation board (CSAB) promoting quality education in the computing fields", *Inroads*, 1(2), June 2010

[12] ABET, "Criteria for accrediting computing programs - effective for evaluations during the 2011-2012 Accreditation Cycle, October 2010, downloadable from http://www.abet.org.

[13] Hou Yung-Chi, A. (2009), 'Student learning outcomes and quality assurance of higher education in Taiwan', *Proceedings of Conference on QA and Student Learning Outcomes of HE in Asia-Pacific Region,* Taiwan.

[14] Hussey, T. and Smith, P. (2002), "The trouble with learning outcomes", *Active Learning in HE*, 3:220-233, 2002.

[15] Yaverbaum, G., D. Lidtke, H. Reichgelt, S. Zweben "Outcomes-based computing accreditation: program assessment", *Proc. of the 38th SIGCSE Tech. Symp. on Comp. Sc. Education*, March 2007.

[16] ACM/IEEE, "*Computer Science Curriculum 2008: An Interim Revision of CS 2001",* Report from the Interim Review Task Force, Endorsed by the ACM Education Council, November 15, 2008, Endorsed by IEEE Computer Society Educational Activities Board, November 16, 2008, http://www.acm.org

[17] NCAAA - National Commission for Academic Assessment and Accreditation, "*Standards for Quality Assurance and Accreditation of Higher Education Program"*, Riyadh, Saudi Arabia, http://www.ncaaa.org.sa

[18] NCAAA - National Commission for Academic Assessment and Accreditation, "*National Qualifications Framework for the Kingdom of Saudi Arabia"*, Riyadh, Saudi Arabia, http://www.ncaaa.org.sa

[19] NCAAA - National Commission for Academic Assessment and Accreditation, "*Handbook for Quality Assurance and Accreditation",* Riyadh, Saudi Arabia, http://www.ncaaa.org.sa

[20] Fuller, U., J.C. Little, , B. Keim, C. Riedesel, D. Fitch, S. White "Perspectives on developing and assessing professional values in computing". *SIGCSE Bulletin*, 41(4), January 2010.

Websites, all accessed as of April 2011

http://www.aacsb.edu

http://www.abet.org

http://www.acm.org

http://www.apqn.org/

http://www.aquanet-services.com/

http://www.architecture.com/

http://www.canqate.org

http://www.ceenet.org/

http://www.chea.org/degreemills/

http://www.computer.org/portal/web/guest/home

http://www.ecaconsortium.net/

http://www.efmd.org/
http://www.efmd.org/index.php/accreditation-/equis

http://www.enqa.eu/

http://www.hrk.de/de/hrk_international/3819.php

http://www.ieee.org

http://www.inqaahe.org/index.php

http://www.lecames.org/index.php

http://www.mqa.gov.my/aqan/

http://www.naab.org/

http://www.ncaaa.org.sa/english/adefault.aspx

http://www.nica.ru/eng/naa/activity/international/networks/ecoko/

http://www.nokut.no/noqa

http://www.riaces.net/

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