Accreditation and Academic Audit Strategies for the Information Technology Faculties in Jordan

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***Abstract*: With the existence of several public and private universities in Jordan that offer graduate and undergraduate degrees in the IT fields, competition is very high for attracting best students. On the other side, the Ministry of Higher Education is working toward assuring that such inflation in the number of universities and graduates do not come at the price of quality. As such, recently, there are several trials on trying to evaluate the quality of education, curricula and graduates in the fields of IT. In this paper, an assessment framework is proposed to help in the evaluation of the IT majors toward the goal of local and international accreditation. The framework described all educational system stakeholders and their possible interests and contributions to the improvements of this system. It is believed that with no real coordinated and effective communication between all contributors, the quality of education will lack the real momentum to be as influential as expected.**

***Keywords*— Accreditation, Higher Education, Quality Assessment, and Information and Communication Technology (ICT).**

I. INTRODUCTION

The higher education is evolving all over the world. In particular, the Information Technology (IT) education is one of the unique fields of education in that it is continuously and rapidly evolving in a relatively short amount of time. This may not be true for the majority of other fields of study such as science, literature, economy, linguistics, and even engineering. Such continuous evolution puts a huge deal of pressure on those working in this field whether they are students or instructors. An IT instructor should always improve his/her educational skills and study new technologies as his/her previous knowledge may expire in a relatively short amount of time. While this may not be applied for the core sciences of IT such as Artificial Intelligent (AI), formal methods, digital logic, basic programming skills, etc, where the core concepts are stable however, such fields will always have new and evolving knowledge in the methods, tools, algorithms, features, etc. This is not the case for the majority of the other fields of education that includes: education, literature, science, physical education and even engineering to a large extent.

Such evolution is also impacting the way such majors may be taught or accredited. What is valid helpful, and useful to students to teach two years ago may not be the same today as it is not a trend in the research or the market. Such challenges are not local to Jordan or any other country in particular. In many universities many IT courses are mapped in a general format before the semester starts, where its actual or detailed content and course description are elaborated at the beginning of the semester. Instructors will consider the best ways to develop such courses given the prevailing context.

The initial trigger to writing this paper is the current movement in Jordan and the region to accredit all university majors according to well defined local and international standards. The majority of IT faculties are lacking the preliminary requirements for such accreditation due to several factors. The large number of students accepted in every faculty and the relatively small number of faculty members in each college are challenging. In this paper, we will try to first survey selected international known universities to study their current IT educational system. Examples of the factors that we will focus on are: Curricula, course content, methods of teaching, examination and some possible quantitative metrics such as number of students, faculty members, etc.

Challenges of applying quality concepts in IT education in Jordan will be investigated with possible solutions. Finally, a framework on the assessment

criteria to evaluate such system will be developed and assessed.

The rest of the paper will be organized as follows: the next section will introduce related work in this field. Later one the major body of the paper will include those 3 parts discussed in the previous paragraph. The paper will be end with a short conclusion and possible future work.

II. RELATED WORK

Total Quality Management (TQM) grows as an advanced management tool. Several research papers and documentation were produced to show the practical implementation of TQM. TQM has its ups or downs in the hype as an effective or useful management tool (or philosophy) where some saw its value more than others. In theory, TQM can be defined as "A business improvement philosophy which comprehensively and continuously involves all of an organization's functions in improvement activities" [10].

Donev and Barudov introduce the usage of IT and quality assessment factors [2]. In the majority of papers that are discussing the role of IT, it is presented as a factor that can enhance education quality relative to traditional educational methods.

Denoya paper proposed a plan for higher education quality assessment through: accreditation, curriculum model and academic audit [4]. The use of such combined quality strategies can help in monitoring quality assurance and continuously striving for improvement in institutional effectiveness.

Kitagaki et al. proposed a higher education on-line system which is useful for digital information retrieval [5]. The goal is to keep students and instructors information current and up to-date and keep them aware of all new information related to their research interests.

Parthasarathy et al. paper used cause and effect (or Fishbone) diagram and the Pareto chart to identify and prioritize factors that may affect educational quality and that would have to be targeted to assure an increase in the quality of higher education [6]. The diagram listed all necessary skills required to improve the students' learning outcomes. The paper indicated through students' survey that seminars and industry exposure are important factors that can help in improving students' knowledge.

Alzoabi et al. introduced the Quality Assurance Automated System (QAAS) to enhance higher education quality assurance in the Arab international university [7]. Those enhancements include: Students feedback applications, following the study plan, industry feedback, second and external examiners.

Marcus et al. used a survey to evaluate students' higher education satisfaction and used it as a quality factor [8]. However, the majority of factors in the survey in which students responded to with low factors were not related to academic issues.

Wenjian et al. used Support Vector Machine (SVM) regression analysis to evaluate China higher education quality where the advantage of this model that it does not have a strict requirement on the number of samples [9]. The study evaluated and ranked 5 major universities in China based on this model. Examples of the attributes that were considered in the evaluation include: student-teacher ratios, education expenditures, the number of teachers with title of associate professor or higher, and other related factors.

Gao et al. proposed a fuzzy comprehensive evaluation method for higher engineering education [10]. The study divided the higher educational influencing factors to an index with three factors: education, education process and education quality factors.

Chun-hong and Sheng-min proposed an evaluation model for computer courses [20]. Figure 1 shows a conceptual diagram that depicts the relationships between learning classification, course objectives and other evaluation factors.

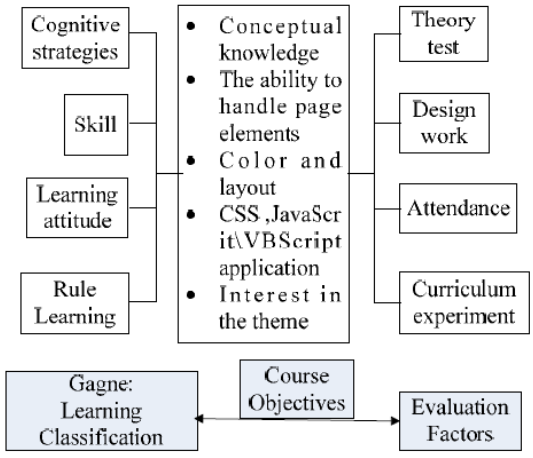

Fig.1: The relation between Learning classification, course objectives and evaluation factors [20].

The evaluation factors listed are: Theory test, design work, attendance and curriculum experiment. Table 1 shows George Mason University's adopted IT related success factors [21]

TABLE 1
GEORGE MASON UNIVERSITY'S ADOPTED IT RELATED SUCCESS FACTORS [21]

Category	Characteristics
Mission, goals, and objectives; planning	■ Broad participation—campus and community ■ Input solicited from key community stakeholders ■ Goals: measurable, regularly evaluated and reviewed, consistent with institutional goals ■ Established priorities and resources ■ Strategies of implementation and adaptation ■ Formal and informal communication
Administration/ institutional support	■ Strong, consistent leadership ■ Ongoing funding ■ Appropriate staffing ■ Collaboration encouraged ■ Achievement and participation rewards ■ Broad-based awareness and support
Integration with curriculum	■ Emphasis on student learning ■ Local governance structures ensure institution-wide implementation ■ Competencies by discipline and course level ■ Appropriate sequencing ■ Participating programs/courses identified
Collaboration	■ Broad-based participation (level, discipline, role) throughout
Pedagogy	■ Student-centered, active learning ■ Diversity of approaches ■ Technology integrated ■ Openness to innovation ■ Builds on existing knowledge ■ Linked to coursework and real-world experience
Staff	■ Faculty, librarians, IT staff, administrators, etc. ■ Adequate in number and skills ■ Systematic and continuing professional development; release time provided ■ Serve as role models/advocates ■ Regular evaluations

III. GOALS AND APPROACHES

Wohl and Sage presented an overview of a huge size of current work that includes: productivity, total quality management, organizational cultures, professionalism, higher education, and engineering [1]. The paper listed examples of educational success factors such as: encouraging interests in real problems, encouraging team efforts, develop abilities to function well in a wide range of related disciplines, develop the ability to integrate science and technology deep understanding with practical human knowledge. Those factors are very relevant to IT students where they are exposed to a field that is connected to several different fields of science.

The IT field requires also team coordination and students ability to correlate theoretical education with fields or business problems. They are also expected to build a common sense of knowledge and the ability to find proactive solutions in a continuously evolving field of knowledge. The paper summarized responsibilities for improving quality within universities on three main parties: Government, industry and universities. In this paper, we will adapt and enhance this framework. Following are summarized responsibilities for those three parties [1]:

1) Government Responsibilities:

- "Make research on generic industrial technologies a national Research and Development (R&D) priority". The type of generic industrial technologies that may fit Jordan should be defined well. Currently, higher education in Jordan is not focused and universities are not trying to focus on certain areas in any field of science.
- Create an economic climate that more conducive to investments in technology, including innovation and manufacturing. In Jordan, IT is one of the sectors that many local and international companies invested in this sector whether in hardware, software, or network applications. It is estimated that this total investment is raised from 500 million Jordan Dinars (JDs) to 2200 million in the last 10 years and revenue is raised from 13 to 210 million. Table 2 below shows some of the metrics that show the impact of the ICT sector in Jordan economy.
- "Communicate technology and competitiveness priorities to the public and intensively involve policymakers in these issues". For years, Jordan was trying to progress in this aspect, especially in the ICT sector through following open policies regarding improving the country on ICT technologies and business sector such as: e-commerce, software development, etc.
- "Develop policies and programs for a world-class technology infrastructure". Jordan moved many steps in this area, where many policies where issued related to the Internet, mobile and wireless technologies.

2) Industry Responsibilities.

- "Establish Industry groups and networks to accelerate and facilitate technology dissemination, commercialization, and leadership in critical emerging generic technologies". If we want to focus on the ICT field, the critical section is largely through improving Jordan telecommunication and Internet connectivity. The Ministry of ICT is working aggressively in the last few years trying to expand the usage of the internet and other related technologies all over the country.
- "Establish objectives for organizations to become dominant among competitors, domestic and foreign". The original paper was written to the US industry which has several infrastructural elements that supports the industry to be a dominant one. However, in Jordan, the focus is to make the country a regional hub for certain technologies.
- "Increase direct industry-university working relations in critical technology areas". In Jordan, this

is scarcely utilized. There are no serious connections between the industry or private organizations and universities. In many countries around the world, university students, specially, in the ICT field, can get real industry experience through cooperative education (CO-OP) projects.

3) University Responsibilities.

- "Develop close ties with industry to ensure that critical technology developments are communicated and transferred to students on a priority, expedited basis". As explained in an earlier paragraph, a real mutually beneficial partnership between the universities and the industry in Jordan is far from reality. Both sides are not aware of the possible advantages and not trying to initiate such partnership.
- "Ensure that educational programs in education and management reflect real needs". This issue may get serious discussion and opinions with and against it. While there are very good advantages in modifying universities' study plans to fit the local industry needs, many academics think that curricula should follow internal academic standards that may not be synchronized with the local industry needs. In addition, many academicians believe that the gap between what universities teach and what the industry needs should not be melt specially as university education is not targeting industry technical fields. Such role is more linked to community colleges.
- "Maintain strength and relevancy of engineering and science programs such that they address long-term research needs extant in industry".

In order to propose a quality assessment metric for the IT graduate studies in Jordan, we will first elaborate on all players of the education system with their roles and possible metrics.

Figure 2 shows the actors and their value attributes in the proposed framework.

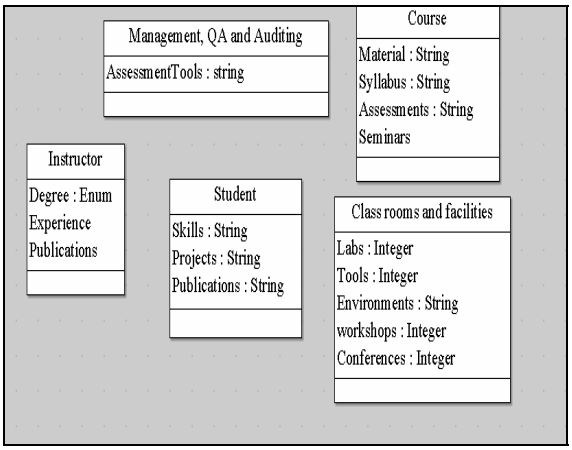

Fig. 2. Framework for higher education quality assessment.

TABLE II
THE IMPACT OF THE ICT SECTOR IN JORDAN ECONOMY, SOURCE: JORDAN MINISTRY OF PLANNING. (WWW.MOP.GOV.JO)

Sector Metric	**2008**	**2012**
Sector competition	**44/134 countries**	**Advanced position**
Income (Million JD)	1.9	3
Contribution to the local income	14.3 %	16%
Job opportunities (in thousands)	22	40
Computers number relative to the total population	7 %	9.5 %
Internet usage relative to the total population	26 %	60 %
Cell phone usage per 100 citizens	91%	120 %
Number of schools connected using fiber optics	284	1725
Accumulated number of national electronic services	46	171

Following is an elaboration on all actors with their relevant attributes.

1. *Instructors*: Each instructor is expected to have and sustain a certain level of knowledge and skills. Those skills should be on both education and research levels. Universities always assure the dual roles of each university instructor (teaching and research). In reality, there is a third one which is community service; out of scope for this paper. In Jordanian universities, while most universities can be considered as teaching institution based on their instructors' work loads and class sizes, they encourage instructors to publish research to improve their rank or in some cases to keep their jobs. This is somewhat contradictory as universities in Jordan have heavy teaching loads (12 for assistant professors, and 15 for lecturers). In addition, the number of students in each class is large and instructors usually do not have teaching assistants to help in grading or lab work. This indicates that roles and players of the framework are connected which means that we can't improve the instructor's attributes while courses and other attributes are not improved. On the other hand, instructor's experience may not be very relevant for IT education where courses and subjects continuously evolve and change.

The number and quality of publications are very important quality factors for both the instructor and the educational systems. As explained earlier, the shortage or the lack of quality publications in Jordan is due in large to two main factors: Research support funds and the busy and occupied time filled with purely educational tasks. In some universities such as Yarmouk University, where salaries are low

relative to even local universities, instructors take extra courses over the already filled schedule in order to get some extra income. Without seriously improving the income status of instructors, talking about publications and research will always stay for theoretical and show-off meetings.

Scientific research funding in Jordan started to improve recently. However, challenged with many obstacles, such research support is still lacking because of its tedious auditing and lengthy acquisition process. The research fund itself needs to have procedural quality attributes and metrics. Currently research support funds go in a tedious bureaucratic unstructured evaluation, selection and monitoring procedures.

2. *Students:* Evaluating the quality of graduate students can take or focus on several attributes. In Figure 2, we listed some of those possible attributes such as:

- Skills: The main goal of education is to improve students' skills. This is very relevant for majors such as those of the IT where we are talking about an applied field of study (unlike arts, education, physics, etc where theory and knowledge is the focus). For IT students to be successful, they need to have theoretical and practical skills.
- Projects: Many universities around the world enable students to work on real projects through what is called CO-OP projects where Local IT companies submit project to the university and students select projects that are relevant to the course they are taking. Such projects can help students be exposed to actual projects and real work environments. They can also build their team work skills and build their communication skills working with these projects. On the other side, these companies can have workers to work free on some of the ideas or projects that they may want to assess or test before the actual implementation. They will also have the opportunity to know students who have relevant skills rather than hiring them first in order to know that.
- Publications: For graduate students in particular, publications and the experience of attending and working in workshops or seminars are necessary and one of the good quality indicators. Many websites that evaluate or rank universities around the world takes into consideration the publications of both instructors and students.

3. *Courses:* Courses or educational materials are considered as the raw material or the input to the educational systems. There are many attributes that can be used as indicators for the quality of the educational material. Many Quality Assurance (QA) models focused on the table of content, syllabus and educational methods as their main quality metrics. Instructors should have clear and visible contents and syllabus that agree with the course plan. However, one of the challenges in the IT field is the fact that the life of many courses can be very short and that there is a need to continually evaluate and update course contents. This is a double side challenge where it is problematic if instructors don't continually evolve and reevaluate their course contents. However, such evolution should be somewhat structured and not ad-hoc. In some courses, finding a text book that is relevant and up to date is a challenge. This should not be problematic if a good quality material can be collected from other sources such as the Internet.

Other important supportive methods of teaching are needed in the IT field such as computer labs, simulators, videoconferencing, and seminar sessions to ensure that students are capturing the essence of knowledge and acquiring the needed skills and competencies. For years and due to many factors, many universities ignore partially or completely the need for computer labs for the majority of the courses. The challenge was that labs are expensive, usually can't have large number of students, complex to manage and run. For purely convenient reasons, many IT faculties in Jordan abandon such labs for the majority of courses. This reflects clearly on the quality of their graduate students. Finally, course assessment methods are affected by many factors like class size, availability of teaching assistants, and work load. Many universities around the world support instructors with teaching assistants for grading assignments. One of the major quality tools that are rarely used in Jordanian universities is "course portfolio", where or related material of a course is accumulated and kept for future use and analysis.

4. *Classrooms and facilities:* Many universities and majors in Jordan are facing problems with their quality auditing due to the fact that they are not fulfilling class room and facility requirements. This is extremely relevant to IT majors where number of students in classrooms should be small. Class rooms should also be equipped with all modern ICT equipment to help instructors provide interactive education. Labs should contain all necessary operating systems, and required educational programs. They should be relatively new, connected to the Internet and assisted by all office facilities such as printers, or scanners. Facilities should be easy to access and available for students most of the time. In many IT faculties in Jordan, those same labs are used for IT and university education. They are also used

for students' services, registrations, exams, etc. This makes them unavailable for students for the majority of the time.

5. *Managers, quality officers, and auditors:* In order to evaluate and continuously improve higher educational systems, proactive university managers should be in charge; to continuously monitor progress. They should have dashboards that allow them to gain access to real time quality metrics such as all those mentioned earlier. Such metrics should not only focus on pure tangible figures such as income, number of students' ins and outs, or number of given courses or earned degrees. They should be able to monitor and regularly scan more intangible and quality relevant attributes such as publications, students' gained skills, and labs availabilities and readiness. Table 3 summarizes the stakeholders' main attributes and their possible metrics.

TABLE 1II
EXAMPLE OF SOME EDUCATIONAL QUALITY ATTRIBUTES AND METRICS.

Stakeholder	**Attribute**	**Metric**
Instructors	Research	publications
Instructors	Teaching	Students assessments
Instructors	Research	Number of taught courses
Instructors	Research & Education	Income
Students	Skills	Assessments, exams, etc.
Students	Research	Publications
Students	Skills	Conferences, workshops, Co-Ops
Courses	Material	Syllabus, Content
Courses	Quality	Students gained skills
Courses	Quality	Evolution
Courses	Quality	Course portfolios
Facilities	Availability	Number of working labs
Facilities	Quality	Current, up to date
Managers and QA	Monitoring	Dashboards
Managers and QA	Communication	Meetings, reports, policies

IV. CONCLUSION AND FUTURE WORK

The large number of IT graduates in Jordan and the great amount of investment in sector entitles for the needs to evaluate the knowledge, skills, and competencies of those graduates. In this paper, we proposed an assessment framework to evaluate the IT higher education sector in Jordan. This framework focuses on the major players or stakeholders: students, instructors, courses, facilities and managers. Initial findings show that metrics for all players complement each other. Improvements of some attributes may improve some other attributes by default and vice versa.

In this paper, a preliminary evaluation framework for the quality of education is proposed. The framework listed all educational system stakeholders and their roles, responsibilities and interests. A thorough explanation of all issues described earlier should be developed to introduce a manual on how to evaluate this system and its ability to help in improving students' ability to gain or observe sought knowledge.

In future, we will make an empirical assessment of the situation of IT faculties in Jordan based on the proposed framework. Some other quality assessment techniques such as Data Envelopment Analysis (DEA) will be used to compare productivity and quality among all evaluated universities.

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