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WCEE 2015

ABSTRACTS

WORLD FEDERATION OF ENGINEERING ORGANIZATIONS
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The papers submitted to the congress is a publication of the WFEO Committee on Education In Engineering, addressed to engineering educators, educational officers at Universities and leaders responsible for establishing educational policies for engineering in each country. The articles it contains reflect the concern of educators, universities and institutions, to provide ideas and proposals, with the intemtion of improving engineering education.

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Congress Abstracts

1 A New Future for Engineering Licensure

Author Paul F. Boulos, Ph.D., Hon.D.WRE, Dist.D.NE, Dist.M.ASCE, NAE
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Abstract Although certain basics of engineering will not change in the future, the explosion of knowledge, the global economy, and the way engineers learn, work and innovate will reflect an ongoing evolution, and we must prepare well for this wave of change. Future civil engineers will need to master many newer fields, such as sustainability, computer applications, advanced materials, nanotechnology, and the like. The need to *Raise the Bar* for future entry into engineering practice at the professional level has been articulated by the National Academy of Engineering (NAE), the National Society of Professional Engineers (NSPE), the National Council of Examiners for Engineering & Surveying (NCEES), and the American Society of Civil Engineers (ASCE). The *Raise the Bar* initiative promotes raising the basic educational requirements for licensure of future professional engineers beyond a bachelor's degree and to intensify the pre-licensure experience to meet their responsibilities to protect public health, safety and welfare. This keynote summarizes the guidelines and objectives of this strategic initiative and its implications to engineering students and faculty in the U.S. as well as signatory and potential signatory countries of the Washington Accord.

2 Developing Engineering Skills: An ongoing Debate

Author Kamel Hawwash BSc, MSc, MAPM, FHEA, Professor in the School of Civil Engineering, University of Birmingham.

Abstract Abstract: The past few years have witnessed a steady stream of reports either from Government Departments or industry calling into question the skills that graduates have upon leaving university and entering the world of work. The Engineering Education community can appear to be on the defensive when attempting to respond to these questions. The reality is that many stakeholders are involved in the development of engineering graduates and understanding what each stakeholder can contribute and then identifying effective ways of bringing these contributions to bear is very important. This presentation discusses the recently launched European Society for Engineering Education (SEFI) position paper on 'developing engineering skills' and the plan for developing a more detailed approach to this important topic. The paper argues that engineers are transforming the world and that in order to do that, the various stakeholders must work together to ensure their student experience develops both technical and reflective thinking skills, among others.

3 The Standing of Professional Engineers and the Processes on Which It Is Founded

Author Dr. Peter Greenwood, Executive Vice-President WFEO, HonFIEAust, EngExec, FIET, SMIEEE

Abstract This paper is strongly linked to WCEE 2015's theme of sustainability. The paper discusses the processes and infrastructure and the main stakeholders in the on-going need to produce quality professional engineers.

Trading service across and within national boundaries involves the engineering sector and the standing of its engineers. Trade is also affected by the availability and location of certified professional engineers — loosely referred to as the Mobility of professional engineers.

The World Federation of Engineering Organizations (WFEO) plays a number of important roles. The main international accreditation and certification agreements and organizations, which I will refer to as "iaca", are mostly well established and others are increasing their participation. More countries want to improve the certification of their engineers and to acquire the capacity including appropriate processes, administrative staff and physical resources within which to operate.

"iaca" have shifted their focus from certifying individual engineers and quality control of the processes, towards cooperating with their peers and providing assistance to countries that aspire to national or international recognition.

A comprehensive model is used to illustrate what is needed and who needs to be involved.

The related activities of international engineering organizations are described and WFEO's involvement is explained. The emerging partnership between WFEO and the International Engineering Alliance (IEA) is offered as an example of the need for close cooperation in giving help and informing governments and interested international organizations.

The need to raise awareness is shown to be very important and some of the wider issues are raised.

4 Future of Engineering Education in Lebanon

Author Professor Ahmad Jammal- Director General of Higher Education Lebanon

Abstract Higher education has to develop in order to meet the challenges of the Globalisation and the inclusive growth sought in many countries. Developing Engineering education is in the frontline in responding to these challenges. Engineering education as an applied and down to earth science should contribute to the development of communities and is the basic component for progress and technological development

One of the main challenges to be faced by the Engineering education in this century is to develop an integrated educational system that offers engineers a comparative and competitive advantage in a globalized and privatized market.

There have been many big changes on the patterns of thinking and learning in the philosophy of education at the level of creativity, learning theory, curriculum and technology education control. Engineering education has, before any other discipline, to follow these changes and adapt to its requirements in terms of concept and tools. On the other hand, we see that the rapid growth of technology has helped in the dissemination of knowledge, and made information and data at hand, and that had a significant impact on the engineering profession during this century.

In addition, the increased mobility in the workplace is generating pressure to expand competencies beyond countries. Hence, internationalisation and international competencies have to be taken into consideration in any design or conception of new curricula or programmes.

In Lebanon, the numbers of institutions that offer engineering programmes have increased from 7 before the year 1995 to 17 currently. The number of students in various engineering disciplines in the year 2014 is approximately 25000 students. Different systems are applied in Engineering studies in Lebanon: 5-year study (LU, AUB, BAU, …), 3-year Bachelor + 2-year Master (UOB, RHU, …) and a special system applied at CNAM-Liban.

We believe that, with this substantial increase in the number of students, one must go on with radical reforms in this area based on self-evaluation and external assessment of engineering programmes. This should also be based on the learning outcomes of these engineering programmes and on their impact on the development of the country.

Many ideas are proposed in that regard: Quality Assurance and accreditation processes, continuous audit process, implementing Colloquium examinations in Engineering and reinforcing the admission criteria to engineering programmes.

All these actions require new legislations that need national dialogue with the Orders of Engineers and with all other stakeholders concerned by the sector.

5 The Evolution of US Engineering Education in the First Two Decades of the 21st Century

Author Fadi P. Deek, PhD, Provost and Senior Executive Vice President, New Jersey Institute of Technology

Abstract During the last quarter of the 19th century, engineering education in the United States, now about 150 years old, was subject to significant changes in direction in every generation. From a hands-on focus using apprenticeship models in the first fifty years, engineering education has undergone a strong shift toward an "engineering science" focus starting in the 1930s. This trend toward stronger theoretical basis research and rooting of engineering education in science has accelerated rapidly after World War II. Later developments, starting in the mid 1960s, expanded engineering education into new disciplines (most notably computer biomedical engineering and signal processing). In the 1980s and 1990s new requirements were imposed-including the formalization of content in oral and written communications and team work culture; inclusion of economic imperatives and ethics in curriculum; and requiring better understanding of the societal impact of engineering work. The "swinging of the pendulum" toward theory was moderated somewhat by new emphasis on hands-on experience and lab work.

The early decades of the 2000s have introduced new challenges. Traditional engineering work has migrated from its old geographical centers to new venues and from its traditional practitioners (individuals with baccalaureate degree in engineering) to diverse groups with other educational backgrounds and titles (including computer scientists, information technologists, "hackers", and non-engineer designers). The role of computing in engineering practice has grown significantly, and the intersection between engineering computing and, the life sciences has become one of the most dynamic areas of growth.

In this presentation we will discuss how these changes are affecting the curriculum, practice, and management engineering education in the United States. We shall also consider the likely evolution of engineering education in light of the new trends in engineering disciplines student demographics, professional mobility, program accreditation and licensing.

6 Sustainability in Engineering Education and the Proposed Abet Requirements

Author Dr. J.P. Mohsen, Vice Chair WFEO-CEIE, Professor and Chair at University of Louisville, KY - USA

Sustainability principles have long been considered by design engineers in terms of allocation of resources and serviceability of systems. However, it is only rather recently that sustainability related principles have become part of the course offerings in engineering educational programs. The most recent modifications to ABET students learning outcomes require each civil engineering program seeking accreditation to show evidence that the students graduating from the program have an understanding of sustainability principles and provide evidence that they indeed can incorporate them in design. The details of the impending requirements and proposed methods with which these new requirements can be met will be discussed and shared.

Examples of how various engineering programs currently meet these criteria will be given. Additionally, the available resources developed to assist in preparation for the proposed requirements will be discussed.

7 EUR-ACE® Framework Standards and Guidelines

Author Dirk Bochar, Enaee Vice-President - Feani Secretary General

Abstract ENAEE (European Network for Engineering Accreditation) was founded on 8 February 2006, after the successful conclusion of the EUR-ACE® Project which was supported by the EU Socrates and Tempus Programmes and by 14 European associations concerned with engineering education. It stemmed from ESOEPE, the "European Standing Observatory for the Engineering Profession and Education", that had been established on 9 September 2000.

ENAEE is rooted in the so-called Bologna process which aims at building a European Higher Education Area (EHEA), by strengthening the competitiveness and attractiveness of European higher education and fostering student mobility and employability.

ENAEE addresses specifically the education of engineers, whose importance is increasing in the global economy. ENAEE aims to enhance and promote the quality of the education of engineering graduates in order to facilitate their professional mobility and to enhance their individual and collective ability to fulfil the needs of economies and of society.

To achieve these goals, ENAEE authorises accreditation and quality assurance agencies to award the EUR-ACE® (EURopean- ACcredited Engineer) label to their accredited engineering degree programmes. To be authorised, an agency must satisfy the standards published by ENAEE in the EUR-ACE® Framework Standards (EAFS) document. These standards incorporate the views and perspectives of the main stakeholders (students, higher education institutions, employers, professional organisations and accreditation agencies). The EAFS document is the precursor to this new document, the EUR-ACE® Framework Standards and Guidelines (EAFSG) published here.

8 Ethics and Professional Conducts-Key Prerequisites for Sustainability

Author Kamel Ayadi, Chairman of Global Infrastructure Anti-corruption Centre for MENA Region Past President of WFEO, and founding chairman of its standing committee on Anti-corruption (2007-2013).

Abstract In this paper the author will analyze the other ways to achieve sustainability, through the focus on ethics and professional conducts.

This paper will demonstrate how endemic corruption retards economic growth, hinders social stability and damages environment and therefore undermines the main pillars of sustainability. Corruption and sustainability cannot coexist together. A Number of empirical studies have demonstrated the existence of significant relationship between corruption and environment sustainability. These studies are mainly based on reconciliation between two aggregated indexes, the Corruption Perception Index (CPI promoted by TI and the Environment Sustainability Index (ESI)of the WEFCPI is based on perception of corruption, mainly among business people.CPI offer a global ranking .ESI is an assessment of a number of variables that influence the environmental health of economies.There are similarities and parallel in the assessment of the environment situation and the corruption within a country. Significant Correlation exists between both factors:

1/Both Corruption and environment are transnational

2/ Both CPI and ESI are positively related to GDP per capita

3/There is a direct effect between corruption and sustainable environment, in the sense that corruption interfers with law enforcement, monitoring, rule of law.

9 Engineering Ethics & Sustainability

Author W.E. Kelly, George Mason University, Fairfax, VA, USA

Abstract Engineering ethics and sustainability are important components of engineering education and professional practice. Both are included in the International Engineering Agreements Graduate Attributes and Competencies that are the basis for accreditation under the Washington Accord. The purpose of this paper is to review where we are in infusing sustainability ethics into engineering education focusing on Washington Accord signatory countries and to briefly describe an expanded U.S. National Academy of Engineering Online Ethics Center that should be a valuable resource for programs infusing ethics and sustainability into engineering curricula.

10 Ways of Innovating in Education for Sustainable Design Principles

Author Osama Omar, Assistant Professor, Faculty of Architectural Engineering, Beirut Arab University.
Marwan Halabi, Assistant Professor, Faculty of Architectural Engineering, Beirut Arab University.

Abstract In the field of contemporary architectural thinking, students are usually taking the terminology "Sustainable Design" as a theme in their projects. However, due to their lack of awareness concerning the principles behind it, the expression ends up being a baseless word that affects directly their project evaluation. In order to avoid the misuse of such a social impacting ideology, students must be conscious of several principles and guidelines for reaching sustainable design ideas. A definition of a series of criteria of sustainable design must be introduced to students as parameters for their design.

This paper discusses some ways to provide awareness of sustainable design principles by emphasizing the basic approach considerations. They are mainly based on building awareness about sustainable education for a later survey to support the design principle. By such action, a definition of a series of parameters can be clearly defined during the design process, and later the data can be inserted in simulation tools to evaluate environmental performance of the design according to sustainable principles. In the end, a series of measurements will be shown as criteria to evaluate projects to support the designers' decision in addition to increasing awareness when conceiving sustainable design

11 Sustainability and Engineers: A Perspective to Future Generation and Society

Author Antoine Abche, Faculty of Engineering, University of Balamand, Koura, Lebanon

Abstract During the past decades, societies have evolved tremendously in terms of lifestyles, needs, exploitation of resources, practices without limitations while at the same there are people on the planet who are missing the basic necessities to live with their dignities. These trends cannot be sustained indefinitely without depleting earth resources, placing at risk the life of future generations, polluting our environment and harming ourselves. Therefore, another way of thinking is required to allow our lives to be sustained. Consequently, all concerned parties (universities, industries, companies, societies, governments, etc...) should approach the problem and cooperate effectively in order to have sustainable societies. In this work, the issue is addressed mainly from the university perspective. That is, universities, particularly Engineering Faculties, should revisit their curricula in order to address the challenges that are faced when the issue of sustainability is incorporated. In other words, students should learn several crucial and vital principles to attain sustainability and some of these principles are introduced in this paper such as understanding the problem and its impacts, critical thinking, ability to make sound decisions, communication with colleagues who are knowledgeable about the issue at different levels (such as environmental, economical, societal, technological).

12 Sustainable Development Within Suburbs as a Model for Managing Urban Growth: A Case Study From Palestine

Author Salem A. Thawaba, Associate professor, Director: Urban planning and Landscape Architecture Master Program, Architectural Engineering Department, Birzeit University, West Bank - Palestine

Abstract Urbanization is accelerating globally; in developing countries it exceeds 60%, impacting urban centers and surrounding natural resources. Recently, Ramallah a prominent Palestinian city has been considered as a central hub in the West Bank. It is known as the main center for commercial, educational, and cultural activities as well as the center for all political activities. Consequently, demands for residential and commercial projects have been increasing enormously. Scattered development is taking place within city periphery outside city growth boundary regardless landcover and land use. The city attracts people from surrounding villages and rural areas searching for services and work, while these villages lack the proper services and in bad need for

development and upgrading.
A challenge of how to protect and manage agricultural lands is the core of this study, taking into consideration, the protection of the valuable agricultural land in the periphery as a source for food. The study aims at formulating *aconceptual framework on how to manage agricultural land and high quality lands as a means to sustainable development within the scope of urban development.*

13 An Approach For Introducing Sustainability in Engineering Education

Author Maha Mrad, Graduate Student, American University of Beirut
Ghassan R. Chehab, Associate Professor, American University of Beirut

Abstract The world is suffering from overpopulation that is causing an increase of impervious surfaces in urban areas, depletion of natural resources, and degradation of the environment. Therefore, the principle of sustainable development, or sustainability, has been introduced into communities as a possible solution to these problems. Since engineers play an important role in the welfare of communities, they are increasingly being asked to address such problems in design and implementation of projects. On an academic level, this entails that engineering graduates possess the knowledge and understanding of sustainable concepts and methods for their adoption and implementation. However, the main challenge remains in integrating sustainability concepts into a curriculum that is already packed with courses and modules. The aim of this paper is to present an instructional methodology that can serves as a road map for academic institutions to integrate principles of sustainability into engineering education. The paper presents steps followed in establishing and implementing such methodology along with examples at the Department of Civil and Environmental Engineering at AUB.

14 Achieving Sustainable Adaptive Reuse in Architectural Design Studio using Environmental Simulation

Author: Hiba Mohsen, Samer El Sayary, Faculty of Architectural Engineering, Beirut Arab University, Lebanon.

Abstract Education for sustainability must go beyond teaching sustainable strategies in design methodologies. It must give students practical skills that enable them to continue learning after they graduate.
This paper addresses the integration of sustainable design process as a pedagogical approach in the architectural studio which is applied on an adaptive reuse project. It aims to explore the use of building simulation as a tool to evaluate different sustainable solutions, to highlight on the significance of design decisions and to emphasize on improving building performance indicators. It also investigates Blooms taxonomy as a benchmark of student's learning domains, linking it to the environmental simulation in design Studio by developing this methodology of learning architectural design.
An assessment of several projects carried out within design studio course using Design Builder; a simulation software in the design process will be compared with the conventional design method that is based on functional and aesthetic criteria only. The challenge of limiting the design within the constraints of an existing building reveal that site selection impacts the sustainable approach through the design process.
The result shows the significance of this quantitative experiment that can support students in testing different alternatives from the early stage of the design process and manipulate their design based on informed and reliable results to optimize building performance.

15 Sustainability in Civil Engineering Education

Author Nariman Khalil Associate Professor, Department of Civil Engineering, University of Balamand Kourah- Lebanon

Abstract Throughout history, civil engineers have contributed enormously to the development of society and to the huge improvements in the standards of living. Their activities have certainly made some negative impacts on the surrounding environment, society and affected natural resources preservations. Civil engineers, being part of the problem can also be part of the solution, by contributing to sustainable development and green design issues. They have faced many challenges in the past and this is another challenge they have to address. There are many approaches that will help the civil engineers of tomorrow be the leaders of sustainability efforts. This paper focuses on the role of, and need for, universities to create and promote a holistic approach in engineering education. The role of professional societies, as a key part of developing sustainability literacy among future engineers, is also addressed. The paper also looks at local challenges and efforts in the country of Lebanon to promote awareness of sustainability

development. Recommendations are made on embedding sustainability principles in civil engineering programs.

16 Virtual Electronics Laboratory for Effective on-line Education in Electrical Engineering

Author Sreelatha A. Subramanyam, David Beams, and James K. Nelson ,College of Engineering, The University of Texas at Tyler, Tyler, Texas, US

Abstract A current trend in higher-education is on-line education. This mode of instruction is utilized extensively and has been found to be effective in a multitude of subject areas, including engineering education. However, for on-line education to be fully effective in engineering education, a means must be developed to provide on-line students with laboratory experiences that achieve the same learning outcomes as face-to-face laboratories. To address this need, a pilot computer program, Project VELVET (Virtual Electronics Laboratory for Visualized Education and Training), for a virtual electronics laboratory is being developed. VELVET operates on Windows-based computers in a real-time environment. It presents to its user a virtual breadboard into which components may be inserted. A dc power supply and a signal generator are available to supply energy and signals to circuits, and measurements may be made with a virtual multimeters and a virtual oscilloscope. Actions by the user are immediately reflected in the output from the circuits under test. To the greatest extent possible, laboratory conditions have been replicated including component to component variation and powered-on instruments. The theory of VELVET and sample screen images of the program is presented in this paper.

17 Efficiency of Assignments in the Evaluation Procedure at the school of Engineering of the Lebanese International University

Author Oussama Tahan, ZaherMerhi, Samih Abdul-Nabi Lebanese International University, Beirut, Lebanon - Farah Baraké University of Balamand, Balamand Al Kurah, Lebanon

Abstract Properly evaluating students has always been an important task for university faculty members. Academic organizations continuously seek improvements in the assessment strategies at their faculties in order to keep up with the constant changes and alterations of societies, students' backgrounds, technology advancements and curricula. A correct evaluation strategy is the one that gives students the opportunity to test their skills in the chosen domain. Furthermore, it should motivate the students for enhancing their performance while studying and conducting research. Most importantly, evaluation methods need to be well understood, accepted and respected by students. Today, assignments are considered as one of several evaluation practices conducted by engineering departments. In our study, we focus on this evaluation strategy that has always been underestimated by students and keeps being under evaluated. In this paper, we will be investigating the opinion of engineering students from different majors and levels towards assignments given to them. We will be examining the reasons that make them plagiarize their copies or ignoring them and we will be proposing different practical and constructive solutions that help overcome this issue.

18 Combining Teaching Strategies and Learning Styles in the Engineering Education

Author ABOU JAOUDE ChadyUniversitéAntonine, Baabda (Liban)

Abstract Generally, students have different attitudes about learning and have different learning styles which affect their comprehension and processing of information. Engineering instructors should take these facts into consideration by choosing the optimal teaching strategies. Educational researchers proved that active learning strategies encourage a deeper comprehension of the learning material covered in a class; this is due to the fact that these teaching strategies involve the students in the learning process. This article explores the different learning styles and teaching strategies. However this research also highlights the benefits of combining different methods in order to optimize learning efficiency and to promote the teaching reform while achieving diversification of teaching Techniques.

19 Flipping an Engineering Course: Implementation and Results

Author Barbar J. Akle and George E. Nasr

Abstract Recent technological advances gave rise to online and blended classrooms. At the center of blended learning is the flipped (or inverted) classroom, in which the lecture is usually watched on a video outside the classroom while practicing problem solving, group work and discussions inside the classroom. This article compared the efficiency of flipped classroom versus a traditional classroom in a senior Mechanical Engineering course at the Lebanese American University. Two sections of the Control Systems course were delivered simultaneously, one in the traditional

format and the other in the flipped format. The encouraging results demonstrated significant improvement in student performance on exams, and approximately 90% of the students that experienced the flipped pedagogy preferred it over the traditional format and would like to see it implemented in other courses.

20 Experiences and Lessons Learnt From Embedding Sustainability in Engineering

Author Omonigho B. Otanocha, Bland Tomkinson, Helen Dobson School of Mechanical, Aerospace and Civil Engineering, Charmaine Cummings, Veronica Sanchez Romaguera Manchester Business School, Rosemary Tomkinson Faculty of Engineering and Physical Sciences, The University of Manchester, Manchester M13 9PL, UK.

Abstract Problem based learning (PBL) offers educational institutions involved with delivering quality education an avenue for creating a transformational culture with global outlook while enabling students to acquire needed skills for effective engagement in society. Students were able to assume roles as business consultants, through team projects initiatives which required implementation of sustainability ideas. Identification of stakeholders and mapping out how well their respective interests could be satisfied is highly impactful and focuses the students in putting into use skills developed through role-play. Making contacts with professionals within the university and 'clients' from outside organisations made project briefs and outcomes realistic, thereby creating value added experience for the students. Analyses of survey data suggest that students perceived that the PBL course unit had effected changes in their attitudes as well as in their knowledge and skills. Typical transformational feedback from students who were involved with courses based on the PBL approached at Manchester, ranged from strong interests in pursuing careers in sustainability and international developments, social innovation, humanitarian aid, and green businesses. Delivered lectures alone, have been well established to be inadequate in developing critical thinking and required problem-solving skills, for example, professional engineers.

21 A Multi-disciplinary Approach to Developing an Introductory Course in Engineering and Architecture

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Abstract Engineering and architecture is aimed at improving the life of humans by designing and building products and services to the needs of civilizations. In real life settings, designing and building a product/service is a multidisciplinary event that involves the collaboration of a variety of specialists from different backgrounds. Accordingly, students need to acquire multidisciplinary skills and a holistic view of the world to be more successful in their future jobs. A committee of faculty from various disciplines in engineering and architecture at the American University of Beirut (AUB) was entrusted to design and introduce a new course that inspires creativity in engineering and design, engages first-year students from architecture and various engineering disciplines,and above all provides a multi-disciplinary experience to engineering education. This paper presents the theory, pedagogy, and background of introducing such a course to engineering and architecture students at AUB.

22 Climate Responsive and Envirnmentally Sensitive Building Design at the faculty of Engineering and Architecture (FEA) AUB

Author Aram Yeretzian Assistant Professor, Faculty of Engineering and Architecture, American University of Beirut

Abstract Professions dealing with the building industry are expected to integrate passive and hybrid environmental strategies and techniques in building design in order to mitigate the negative impacts on the ecosystem. As an integral part of that industry, Architecture and Engineering students must learn how to design buildings that are sensitive to and harmonious with the environment. To achieve this, a new interdisciplinary educational approach is required to bridge the gap between the disparate domains of the technical lecture and the imaginative studio to ensure that thorough environmental knowledge is integrated with the students' creative skills. In an attempt to sensitize students to the relationship between buildings and the environment, the Faculty of Engineering and Architecture (FEA) at the American University of Beirut (AUB) has been tailoring its curriculum since the late nineties to reflect the growing awareness of the importance of this issue by offering numerous courses that address the subject of "environmentally

sensitive" design. Interaction between Engineering and Architecture disciplines is paramount in teaching at FEA. This approach is intended to create in the FEA graduates an awareness and ability to act within a strategic perspective that relies on the understanding and assessment of environmental and cultural contexts.

23 **Integrating GIS in the Lebanese Curricula**

Author Fatima Mshawrab, Hiba Moussa, and Mohamad Abboud Surveying Engineering, LIU, Beirut – Lebanon.

Abstract GIS is an important information system of high computer-based performance that enables us to understand, interpret, capture, update, map and display graphical and non-graphical information of natural and human-originated events on earth. This system applies spatial observations to bring out these phenomena in a form of synthesis as it is accumulated, saved, processed and presented to the users in coherence. Through years, GIS proved to be an effective application to be used in many studying disciplines at different countries. Our approach is to show the importance of Geographic Information System integration in the Lebanese curriculum as a new way of learning. The study was conducted to cover five schools from different Lebanese governorates It covered three selected lessons from the history, geography and mathematics books of Grade 11 (second secondary level) as a sample to be explained, with evaluation papers for students and teachers that highlighted mainly on their impressions on the application and whether or not the GIS have played role in better understanding to the topic explained and if or not they encourage the idea of implementing GIS in their curricula. The statistical results favored utilizing GIS in teaching as it has enhanced the general understanding of the material and made it better to memorize. Accordingly the statistic results ranked mathematics as number one followed by geography and then history.

24 **التعليم العالي الهندسي والبحث العلمي فيمواجهة تحديات البطالة والاستثمار والتنمية: العلاقات المفقودة**

Author Abdul Hassam El-Husseini, professor of Faculty of Engineering at the Lebanese University

Abstract يدرس هذا البحث واقع أسواق العمل وحركة الاستثمار وعلاقتهما بالتعليم العالي والبحث العلمي. ويحاول الإضاءة على التحدّيات التي تواجه كل منهم، والإجابة على التساؤلات الكثيرة عن أسباب عدم قدرة منظومة التعليم العالي والبحث العلمي في العالم العربي ومن ضمنه لبنان، على المساهمة في تعزيز التنمية وزيادة فرص الاستثمار وتوسيع أسواق العمل، وعن أسباب إنتشار أنواع من البطالة المقنعة والسافرة.

وفي الوقت الذي ساهم التعليم العالي الهندسي في إنتاج آلاف الوظائف وزيادة فرص الاستثمار ومُعدَّلات النموّ في الدول اليُوفِر وفي الدول السريعة النموّ، لا يزال هذا التعليم عاجزاً حتى عن توفير القدر الكافي من المهارات ذات القيمة المضافة لخرّيجيه أو زيادة تنافسيتهم في أسواق العمل، فكيف به والمساهمة في خلق الوظائف وتعزيز الاستثمار.

لقد أدَّت الزيادة الكمية في عدد طالبي الانتساب إلى التعليم العالي في العالم من 100 مليون مطلع القرن الحالي إلى 220 مليوناً، إلى حدوث طفرة في عدد مؤسسات التعليم العالي ودخول الرأسمال الخاص إلى هذا القطاع. وعربياً، يوجد لدينا اليوم حوالي 500 جامعة عربية، و300 معهد جامعي ولو اعتبرنا أن سكان العالم العربي يوازي 330 مليوناً، فإن عدد جامعاتنا لا يوازي سوى 15% من عدد جامعات الولايات المتحدة، ما يعني نظرياً أننا بحاجة إلى سبعة أضعاف هذا العدد... وتكرار نماذج موحَّدة منها حتى داخل البلد الواحد، دون أن يترافق ذلك مع تحسن في النوعية والجودة وهذا ما زاد من خطر الوقوع في البطالة، وإن كان قد ترافق ذلك مع تحقيق انتقال من حقبة "النخبوية" في التعليم إلى فتحة أمام مختلف شرائح المجتمع، من هنا بدأ يُطرح السؤال حول العاطلين عن العمل من حملة الشهادات الجامعية، وهم باتوا يُشكِّلون أكثر من ثلث أعداد الخرّيجين العرب خصوصاً بين الشباب منهم. حتى في الدول العربية الجاذبة لحملة الشهادات والتي تتمتَّع بأسواق عمل واسعة فإن عدد العاطلين عن العمل من الشباب الخرّيجين لا تزال مرتفعة جداً، والسبب يعود إلى ضعف مهارات الخرّيجين وعدم قدرتهم على تبوأ وظائف ذات قيمة مضافة.

من هنا، كان لا بدَّ من العمل على التوفيق بين قدرة الجامعات على نقل المعرفة وتوطينها وإعادة إنتاج معارف جديدة، ومسؤوليتها تجاه المجتمع من خلال تزويد خرّيجيها بالمعارف والمهارات التي تسمح له بالانتقال السريع نحو سوق العمل. وفي هذا المجال لا بدَّ من طرح الإشكالية التالية حول قدرة الجامعة من خلال البحث والابتكار على المساهمة في تعزيز حركة الاستثمار وتوسيع أسواق العمل وبالتالي الإجابة على السؤال التالي، لماذا تستطيع جامعات العالم المتقدِّم والسريع النموّ المساهمة في خلق فرص عمل ولا تستطيع جامعاتنا القيام بذلك؟ ولماذا تستطيع جامعات عديدة أن تجني أرباحاً من خلال تعاونها مع عالم الأعمال؟، بينما يتخذ عالم العمل والأعمال موقفاً حيادياً وحتى سلبياً من جامعاتنا وأساتذتها وخرّيجيها؟ وكيف

يمكن لقطاع الأعمال والإنتاج أن يجني أرباحاً ويوسِّع نشاطاته في دول العالم المتقدِّم والنامي بينما يتردَّد عالم العمل العربي في التعاون مع الجامعات العربية؟

قد يكون ضرورياً تحديد هوية للجامعات العربية، فهناك جامعات بحثية وأخرى للتعليم، وبعضها مُتَخصِّص وأخرى ذات طابع عام... وأين يقع موقع الجامعات الحكومية والخاصة... وما هي آليات تطويرها وخلق بيئة بحثية ملائمة ودور الأساتذة والطلبة في ذلك.

وفي هذا الإطار لا بدَّ من البحث عن دور الدولة في رسم السياسات التنموية وإعطاء منظومة التعليم والبحث دوراً واضحاً ومهماً في تنفيذها ومراقبة آليات التنفيذ ونتائجها. كما أن موضوع تمويل الجامعات والبحوث العلمية يَطرح إشكالية إضافية ينتج عنها عدم قدرة الجامعات على إحترام معايير الجودة... بينما تغيب إشكالية التمويل عن جامعات العالم المتقدِّم بسبب قدرة هذه الجامعات على التطوير والإبتكار وتسويق منتجاتها البحثية، وبالتالي مساهمتها في زيادة فرص الاستثمار وتعزيز قدرة الاقتصاد على النموّ... وهذا ما يجلب إليها ما يكفي من الأموال لسد نفقاتها.

كما لا بدَّ من التذكير بدور الطالب نفسه في تطوير ذاته ليصبح أكثر تنافسية في العمل أو أثناء البحث عن وظيفة، وعن دور مراكز التوجيه المهني والتوظيف وتعزيزها.

لقد قأَدَّت دول شرق آسيا ودول البريكس قاطرة النموّ العالمي... وتحوّلت الصين والهند وغيرهما خلال أقل من عشر سنوات إلى عُمَّالقة في الصناعة والإنتاج من خلال تعزيز ثقافة الإبتكار والإبداع بالإرتكاز على منظومة التعليم والبحث... فما هي يا ترى تلك العلاقات المفقودة بين منظومة التعليم والبحث في الوطن العربي وحركة الإستثمار وأسواق العمل داخله وفي كل دولة... وبالتالي كيف يمكن جعل تعليمنا العالي استثماراً إيجابياً يُؤدِّي دوره في التنمية الإقتصادية والبشرية ويُساهم في تقليص البطالة وزيادة مُعدَّلات الدخل الفردي والوطني.

25 Innovative and Sustainable Entrepreneurship: The Role of Academic Institutions in Lebanon

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Abstract Entrepreneurship is gaining momentum in the world, especially in developing countries, since it is believed to be a main contributor to economic growth and an effective solution for the increasing problem of unemployment. Hence, it is often aligned with the principles of sustainability. Although research in engineering education acknowledges the importance of entrepreneurship at the university level, there is a lack of studies that tackle the issue of student entrepreneurship in developing countries such as Lebanon. Having determined a positive attitude towards entrepreneurship when surveying engineering students from universities about their career aspirations and perceptions, the authors of this paper have also found that many students with entrepreneurial intentions do not have the courage to start their own businesses immediately after graduation. This paper reports on the results of a study which aims at identifying the reasons behind this fear and proposing effective solutions to support sustainable and innovative student entrepreneurship. Feedback was solicited from 30 individuals ranging including university students, professors, entrepreneurs, and entrepreneurial supporters. The paper offers a set of recommendations for the use of academic and professional institutions as well as entrepreneurs to improve the chances of entrepreneurial engineers in transforming their ideas into real successful businesses.

26 Renewable Energy Education in The United Arab Emirates

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Abstract The United Arab Emirates (UAE) has experienced an accelerated drive to harvest the abundantly available solar energy and to increase the share of alternative energy sources in its fossil-fuel reliant energy generation. University research productivity on renewable energy (RE) has been on the rise in the UAE. However, universities have not been able to integrate RE into their core curricula but rather at the senior level in the form of technical electives or senior design projects. This paper surveys the status of RE education in the UAE. It also addresses the actions needed to prepare future graduates for the new challenging RE job market.

27 Web-Based Syllabus Generator

Author Bassam Hussein, Department of Industrial Engineering Lebanese International University.
Samih Abdul-Nabi, ZaherMerhi, Amin Haj-Ali, Department of Computer and Communication Engineering Lebanese International University.

Abstract To improve the university student learning experience, and towards ABET accreditation, it is crucial to have a clear and consistent syllabus encompassing the course learning outcomes and their relationship to the overall program outcomes for every course offered. This paper aims to present the automation of the course syllabus in the multi-campus Lebanese International University (LIU) by introducing a web-based software application for course syllabus generation. The application has been developed using the best practices in educational theories and is fully aligned with ABET guidelines for program accreditation. It streamlines the process of writing syllabi and ensures compliance and conformity for all courses offered within a program. Such automation also contributes to reducing errors, improving the student learning experience, reducing costs and environment harm due to paper printing.

28 Building a Sustainable Partnership Between Private Sector and Academic Institutions in Palestine

Author K. A. Nigim, Professor, School of Technology, Energy and Apprenticeship, Lambton College, Sarnia, Ontario, Canada. H.H. Nigim, Professor, Faculty of Engineering, Birzeit University, Palestine.

Abstract The paper presents the current situation of the post-secondary education in Palestine and in particular to the challenges facing a- building a sustainable partnership between private sector and academic institutions and b- implementing relevant experiential learning and sustainable curriculum development. The paper presents the process that is needed to build sustainable collaborative and effective partnership between the academic institution and the private sector/employer to help in meeting the economic challenges facing the Palestinian institutions, private sector and the young university graduate.

29 An Earthquake Engineering Program Adequate to Lebanon Needs

Author Nisrine Makhoul University of Balamand - Al Kurah

Abstract Even though earthquakes of great magnitude haven't occurred in the last century along the Mediterranean East shore, Lebanon is considered to be a high to moderate seismic risk region. Therefore it is essential to prepare the country to face this threat. One of the crucial steps to be considered is to prepare future engineers right from the start, through an adequate educational program to meet this challenging task.

Seismic engineering science is progressing with an accelerated rhythm, thus it is necessary to endow the future generation of engineers with appropriate competence and knowledge. An adequate University curriculum becomes a necessity: this curriculum is required to be multidisciplinary, since seismic engineering is a multidisciplinary science; multilingual and multicultural, given that globalization has transformed the world into a small town.

The article presents the multidisciplinary and innovative Earthquake Engineering Master's Program proposed for the first time in Lebanon, aiming to prepare engineers to a wider insertion in the local, regional and international market.

30 Identification and Assessment of Potential Environmental Impacts of Cesspits on Selected Groundwater Wells in Tulkarem District using Groundwater Modeling

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Mohammad N. Almasri, College of Engineering, Department of Civil Engineering /An-Najah National University, Nablus, Palestine.

Abstract Groundwater is the major source of water to the Palestinians. The quality of groundwater may be deteriorated over time due to the cumulative effects of several years of practices. The work of this thesis focused on the identification and assessment of potential impacts of cesspits on groundwater wells in Tulkarm District. A particle-tracking model was developed using MODPATH and different scenarios were worked out in order to delineate the contributing areas of contamination to each well of interest. Results confirm that the cesspits considered as one of the main sources of pollution for many groundwater wells in the study area. A wellhead protection zone was delineated

for selected groundwater wells in the study area in order to arrive at effective management plan to minimize the risk of groundwater contamination. Overall, the recommendations call all relevant authorities to assume their responsibilities and to take immediate actions to control an if possible to prevent the groundwater contamination.

31 Online Professional Green Engineering Education

Author Nesreen GhaddarFaculty of Engineering and Architecture, American University of Beirut.

Abstract The American University of Beirut (AUB) with its partners the Lebanese American University, and The American University of Cairo introduced a joint professional online diploma in green technologies. This paper aims to shed light on the market need for online professional education in areas related to energy, buildings and water in the Middle East and to address methods of quality assurance of the online degree and how learning can be improved.

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Abbreviations

AUB	American University of Beirut
BAU	Beirut Arab University
CEIE	Committee of Education in Engineering
CET	Committee of Education and Training
ESIB	University Saint Joseph
FAE	Federation of Arab Engineers
FLE	Federation of Lebanese Engineers
IUL	Islamic University of Lebanon
LAU	Lebanese American University
LIU	Lebanese International University
MUT	Manar University of Tripoli
NDU	Notre Dame University
OEA	Order of Engineers and Architects
RHU	Rafic Hariri University
UA	Antonine University
UL	Lebanese University
UOB	University of Balamand
USEK	Holy Spirit University

USJ	University Saint Joseph
WFEO	World federation of Engineering organizations

Message from Khaled Chehab
President of the Federation of Lebanese Engineers

It is a great honor to welcome engineers from all countries to the 10th World Congress on Engineering Education (WCEE 2015) "Engineering Education for sustainable Development" in Beirut, Lebanon.

The theme of this Congress is versatile and it will be a great opportunity for authors and educators from all over the world to discuss the different visions related to the engineer' s education.

I wish a full success to this gathering and to the future of Engineering Education.

The World Federation of Engineering Organizations

WFEO serves society and is renowned as a respectable and valuable source of advice and guidance on the policies, interests and concerns that relate to engineering and technology. The role and responsibility of engineers in addressing the challenges facing society is more recognized and acknowledged worldwide.

The World Federation of Engineering Organizations (WFEO) is the sole body representing the engineering profession of all kind and disciplines.

Committee on Education In Engineering

The aim of the Education in Engineering Standing Technical Committee (CEIE) is to work for the development of the profession and to work toward the mobility of Engineers around the world. Its aim is to become one of the accreditation agencies for the engineering programs, working together with other international agencies.