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The discussions after the Bologna Process in Europe: The Global Engineer

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Abstract

The discussions after the Bologna Process in Europe is about to graduate a global engineer, i.e., an engineer who thinks globally and acts locally. The engineer's training is long; it is not easy to face the demand for Institutions well-equipped labs, etc. The number of students who choose engineering as a career decreases every year, and it is a phenomenon that occurs in the western world. So, add to the table the need to motivate students who will leave the K12 to pursue careers in technology has been a huge challenge. Another aspect that must be discussed is about the engineering professor who has to deal with very different students than s/he was. About that there is already an organization that for 39 years has been preparing, certifying teachers, engineers and Institutions of education, at the beginning in Europe and now internationally. This organization is present in Brazil, and COPEC – Science and Education Research Council is the only institution that prepares and certifies teachers, engineers in the Americas. From these discussions, many initiatives have been taken and many engineering schools have been implementing new programs with new pedagogical approaches and experiences with good results. Mobility is an important need, hence the European engineer who is trained with the course recognized throughout Europe. In some Countries there is a double degree which is extremely interesting; for future engineer to have an international experience, which is important for developing an understanding of different cultures and respect for diversity and communication. There are differences in the focus of the courses, general or more specific, more or less practical and etc. There is no recipe, an equation that can be applied to all the Institutions to ensure the expected results, precisely because there is a great diversity in addition to the increasingly rapid changes that happen and more embodiments by scientific and technological development. This paper has the goal to instigate the reflection on the formation of engineering teachers in present challenging academic community.

Keywords: Mobility, program design; motivation; global formation; skills.

1. Introduction

No matter the field of expertise civil, electronic, chemical, environmental it is more and more evident the importance of engineering sciences applications in the global world. Industries, governmental agencies, Banks, commercial sector and even civil social groups need engineers prepared in order to solve complex problems and to develop innovative solutions.

Why engineers? Because engineers are prepared to apply the principles of science and mathematics to develop solutions to solve problems. Engineers are naturally driven by results as a characteristic of their mind added by the formation. They work using scientific discoveries to propose applications that meet the needs. It is expected that engineers are highly qualified to perform in their area of expertise.

Due to the present global world any professional have to compete internationally and be aware that opportunities are everywhere and that there is a high possibility for him/her to create the opportunity. This is one of the aspects that should be taken into account when planning an engineering program. Not only this one but many others that will be discussed in this work.

2. Education in Global World

Globalization is not a new concept and isolated phenomenon in men's history it has been happening since the man had to move to better places for surviving. In the past Alexander the Great was may be the first leader to promote the globalization through wars and invasions followed by Genghis Khan, Caesar and others. Now the big corporations are promoting the globalization in a more subtle way, may be less painful and traumatic but still invasive. If it is good or bad the future will tell us, there are pros and cons being widely discussed but the fact is that it is there. It is the evolution of the capitalism system predominant in the world and sciences are occupying its place of relevance in world scenario[01].

Globalization is defined as the transformation of the world in a global village that means real time communication among different parts of the world, which increases the possibilities of personal exchange, mutual understanding and friendship between people. These are facts that promote the creation of a global civilization. Nevertheless analyzing globalization on the economical-financial side it began in the 80's with the integration at world level of the economical and financial relationships. As any change it presents negative and positive aspects.

As positive aspect is the cultural and commercial exchange among people and nations; in the course of two generations the gap between the industrial and the developing regions narrowed substantially everywhere; the overall poverty, when defined by health of population and life expectancy, as well as by income has diminished. By the other hand the results of globalization have not been what was predicted when the attempt to increase free trade began, and many institutions involved in the system of globalization have not taken the interests of poorer nations, the working class, and the environment into account; developed countries are the largest beneficiaries of this system and they are becoming richer while the developing countries are becoming poorer[02].

The discussions about Globalization in general show a bad scenario and the future is unpredictable once it is not possible to foreseen the big players' next movement in such huge business game of fighting for markets.

Academic communities have been discussing the formation of engineers and this matter has received a lot of incentive and many real actions have been applied with success. Many new engineering programs have been conceived and are working well, more flexible programs, more

investments in labs and equipments, more exchanges programs and so on. It is the education evolution in order to adequate the formation of engineers for the future. So Future is the keyword once the world is changing so fast as well as the labor market.

Universities and their Schools and Institutes have suffered the impact by the so called globalization that imposes certain needs that are absolutely new and many of them not so necessary. It is no longer a matter of using multimedia equipment in classroom but fundamentally to look for new more appropriate and captivating contents to present to the new plugged students. Besides all of the technical and pedagogic aspects it is necessary to think about the psychological aspects of this great and passionate process of teaching. For the good or for the evil, there it is this new socioeconomic and political world of contrasts in which only the education can really change for better[03].

3. Engineering Programs Design: Shaping the Future of Generations to Come

Education itself is a science in constant construction like any area of men's life: dynamic, challenging and alive. However one question still remains after all the discussions and changes in education field worldwide: how to form the best professional? As the answers have been so many that it is difficult to say it is this or that. Many Institutions of Education have been seeking for the best ways to provide high level education for their society.

The quality of institutions of education depends on several aspects such as the: quality of classrooms, labs, libraries, communication systems, students ' services, qualification of human resources, pedagogical scientific quality, credibility as a good institution. Good programs have good motivated teachers in addition to modern installations and dynamic planning. The faculty of any institution of education is one of the most important element, which enhance (or not) its qualification of excellence[04].

Design a program principally in engineering is very relevant to its success once it is the backbone of the dynamic and challenging formation of a professional. It is a crusade to prepare the future of generations that will build and handle the world. It is seeing and being managed as business, which it is and valued as a noble mission as well.

These aspects lead to the fact that prepared engineering educators will certainly contribute to the success of the program. So it is also very important to prepare the engineering professor[05].

4. The Engineering Professor

The initial training for teachers in higher education, in the manner as has been practiced involves the acquisition of skills as a researcher and production of knowledge in specific areas, because of the tendency for teachers to make the choice by admission to graduate programs in their areas. It is perceived that specific knowledge of the contents are more valued in detriment of knowledge of teaching and so research ends up getting more attention from some faculty members.

Motivated teachers inspire students to pursue the success in the profession. The teacher is a key element in the formation of any professional. The quality of an engineering program depends not

only on good labs, libraries and etc but also the teachers qualification as educators too and not only as engineers.

It is a fact that has been recognized and that has generated many discussions and researches in this field. It is important to point out that there is an international organization that has been searching and preparing engineering educators for almost 40 years and that is spreading all over the world[06].

The organization is the IGIP – International Society for Engineering Education, which is also present in the Americas and it has been preparing, certifying teachers, engineers and institutions of education with high quality program. Its National Monitoring Committee is in Brazil, more exactly in Sao Paulo State and it is accessible for any engineering professor who desires to foster their formation as well as to have an international certification as engineer educator.

The courses are delivered in a way that fulfills the needs of the engineering teachers to enhance their formation. It is a very dynamic and rich program, developed in modules, following the trend of global formation of professionals, mainly to attend the need of a prepared engineering educator to act in the several different cultural environments, which mobility has imposed as a fact of life for researchers and teachers at graduation level. Not to mention the necessary new competencies of educators such as: evaluation management; development competencies; communication skills; teamwork; ethics and intercultural competencies[07].

Summarizing the knowledge in engineering is important however nowadays it is not enough because of the changes in the educational system and the new kind of student that require different approaches concerning to teaching. So it became imperative to be prepared for this new educational community, where the teachers are the guiders in the new path that is now the accomplishment of the formation of engineers.

5. The Contemporary and Future Engineering Professional Formation

About education for best, the professionals who leave the universities today leave already with a stock of knowledge that is partly obsolete and s/he has to run fast to adapt to the new job market. This is something that has to change and it certainly requires a lot of reflections and actions to change.

The engineering education involves reformulation, impacted by social, economic and cultural changes empowered by the technological revolution and the productive restructuring. Engineers as problem solvers should be more aware of the impacts of any development also at social level[08].

The impacts of unification of world in any level have consequences for all the communities. So it became necessary to prepare since now the engineer to act in the present contemporary society as well as for the future society. It is imperative to help them to develop some skills in order to perform properly in this mutant and challenging society.

International experience shows to be one of the best ways to teach at the present conditions once mobility is higher, communications are easy and accessible for the majority of the world population[09].

The solution of problems now and in the future that engineering faces and will face demand besides the deep technological knowledge the global context of human life and a creative mind.

These skills among others are so important in the formation of engineers. The formation of the engineer must consider besides the strong basis in basic sciences and basic sciences of engineering the development of: effective communication; the willing to learn all life; positive attitudes and behaviors; to work in teams; responsibility for actions and results; respect to diversity; entrepreneurship.

A way to acquire and to foster these skills seems to be the big challenge for the institutions. Many discussions are taking place in many meetings and congresses and the general consensus is that the formation of the global engineer implies the search for ways to foster the qualities necessary to perform globally as well as the assessment of these practices as valuable in a global perspective.

Another aspect is that there is still a long way ahead in order to achieve this professional; government, industries and educational institutions have to work together to facilitate the mobility of students and teachers, to support initiatives that provide international exposure[10].

6. Work Market Today

Innovations in science and technology are shaping the present work market in such a way that from now on “changing” is the role and not the exception. It is a changing world and a changing work market in every level. Technology has enhanced work place that means less hand work and more mental work. Thanks to information technology the workplace is now team-based. Management styles have changed with horizontal structures where everybody is responsible for the results of the work requiring less supervision. For workers in any level the expected profile comprehend attitudes and behaviors to work in teams. The job environment is different due to the way that companies run the business now; jobs positions are displaced, others take places and shifts are always changing in according to the new necessities.

Among the dramatic changes in work market it is noticed that now more jobs are part time; more people are self employed; less staff needed to accomplish works; paid and unpaid overtime work are increasing; global competitiveness; flatter organizational structures; companies downsizing, less job security. Advanced communications technologies continue to alter the way businesses and societies conduct themselves and interact with each other.

Today's engineers are expected to work globally-collaborating with team members located in various countries with diverse languages and business cultures to engineer products and services that insure the company's competitiveness in the global economy.

Men are living now in a changing work environment full of surprises and unpredictable events in a daily basis. The best way to overcome and to survive is to be prepared achieving knowledge and be willing to develop new skills. May be the main skill is the development of the capacity to see the opportunity of a new work, a niche that can be explored and generate good results no matter where it is. The learning of languages and the sensitiveness to behave properly are some of the skills necessary for the new work market[11].

7. Final Considerations

The teaching practice is complex and multi-referential, whose dynamics can only be understood by the action. However it is more likely to contribute to the success of professional development of teachers at any level of education.

The main challenge for the formation of the engineering teacher is the formation of the global engineering teacher, who must be aware of the implications of the formation of future engineers under the paradigm of social, humanistic and ecological perspectives. It is also important the awareness of the importance of her/his performance as educators in the process of teaching /learning, the rescue of the intellectual and reflexive of her/his teaching work in a way that it is not only the deliver of knowledge but mainly the producing of knowledge.

The main challenge for the institutions is to form the global engineer, which actions must lead to provide more opportunities for students to: go abroad for studies and internships; be involved in global teams, working in projects, and designs.

What is necessary in fact is the global engineering educator to inspire the formation of the global engineer.

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