

Evaluation of Engineering Programs in Mexico

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Abstract --- This work presents an overview of evaluation and accreditation for Engineering programs in Mexico under the conditions given by the North American Free Trade Agreement (NAFTA). A new system known as the Council for the Accreditation of Engineering programs (CACEI) has been created in Mexico. This council is the first organization in Mexico for evaluation and accreditation of engineering programs from an outsiders point of view. The second part of this paper deals with the efforts toward evaluation that a private university in Mexico city, Universidad Iberoamericana (UIA) has been seeking to count with high quality engineering programs. An evaluation process, based on ABET criteria, has been implemented by UIA for seven engineering programs.

INTRODUCTION

NAFTA was signed on December 17, 1992 by the Presidents of Mexico, USA and the prime minister of Canada. It began operation on January 1, 1994. On chapter XII, 1210.5, aspects concerning professional services are treated, NAFTA establishes that each one of the parts should elaborate procedures in order to obtain temporary licenses to engineers to operate on 1996.

Multiple reunions have taken place since June 1992 with the participation of professional engineering societies, authorities from the National Society of Professional Engineers (NSPE), the National Council of Examiners and Surveying (NCEES) and ABET from the US. There has been participation from the Professional College of Civil Engineers of Mexico (CIC), Professional College of Mechanical Engineers in Mexico (CIME), National College of Chemical Engineers and Chemists in Mexico (CONIQ), and the Canadian Council of Professional Engineers.

On April 21, 1993, the Professional bodies of Mexico signed an agreement to create the Mexican Committee for the International Practice of Engineering (COMPII). In this committee, the different professional colleges of Mexico participate. On June 1993, the first meeting regarding register and Practice of Engineering took place in Austin, TX. It was agreed that the creation of a Mexican accreditation system would represent an important factor for the increasing the quality of education in Mexico. The three countries signed a declaration establishing the objective of creating this system that could be similar to ABET or the Canadian system in order to count with the approval from these countries. The accreditation system implies the evaluation of engineering programs as well as educational institutions in order to guarantee that the evaluated engineering programs would comply with a set of minimum quality standards.



THE MEXICAN ACCREDITATION SYSTEM: CACEI

A Bachelors degree in Mexico is granted by the Ministry of Public Education through a professional license established at the National Professions Register. This recognition is given to students who finish the requirements of a bachelors program offered by an educational institution that counts on recognition by the Ministry of Public Education. This organization establishes a sort of general requirements on curricula and on the educational institution. However these requirements are basically concerned with consistency from the program and general administrative issues, and not with particular demands for a specific program, not in curricula neither in facilities. For this reason, a Mexican bachelors degree is not recognized automatically by the USA or Canada, meaning that the Mexican professional is requested to pass through a group of professional examinations in order to be recognized at these countries.

As has been previously discussed, NAFTA establishes the need of an evaluation and accreditation system for engineering programs that is reliable for the three NAFTA countries Counting on the support of the National Association of Faculties and Engineering Schools in Mexico (ANFEI) and the Ministry of Public Education (SEP), the Council of Accreditation for Teaching Engineering (CACEI, *Consejo para la Acreditación y la Enseñanza en Ingeniería*) was created on July 5, 1994. This is the first non-government association for evaluation and accreditation purposes that is based on non-institutional observers.

CACEI counts on the participation from several engineering associations, professional colleges, industrial chambers and Ministry of Public Education. CACEI has been growing since its foundation date in terms of establishing general criteria, forming different study groups to develop particular criteria for each group, forming evaluators and beginning to evaluate programs as well as the evaluation system itself.

General criteria has been already established, in terms of comparing this to ABET criteria it has been noted that some of the requirements lack of flexibility and tend to be an image of the structure applied by some government institutions. This is mainly noticed in the quantification of the faculty requirements for basic science teaching as well as for the program faculty.

The same phenomenon can be observed on the development of particular criteria, however this has only been developed in few cases, mainly for Civil Engineering, Industrial Engineering and Electrical and Electronic Engineering. The groups that have been formed are: Civil Engineering, Electrical and Electronic Engineering, Computer Science and Systems, Mechanical Engineering, Chemical Engineering, Industrial Engineering and Bioengineering. This groups are related to the engineering degrees granted in Mexico. It can easily be understood that this groups cover different programs, there are 83 different engineering titles granted at Mexico. For this reason, the possible variations must be clearly specified in order to cover the available combinations at each group criteria. Table 1 shows the 1994 bachelors population of engineering in Mexico, covering over 310,000 students that represent 26.34% from overall bachelors population in the country¹.



Bachelors degree	Population	Pctg.
Computer Science and Systems	82,883	27%
Civil Engineering	37,785	12%
Electronic Engineering	50,254	16%
Industrial Engineering	55,045	18%
Mechanical Engineering	46,814	15%
Chemical Engineering	21,058	7%
Bioengineering	6,183	2%
Others	10,267	3%
TOTAL	310,289	100%

Table 1. Bachelors population for Engineering Programs at Mexico.
This information includes the 83 engineering programs in Mexico¹

The evaluation process has already been implemented at one institution, this has been done by questionnaires that can be filled easily and in a quick manner. Comparing this with ABET, they are more simple and avoid extensive explanations. The evaluators analyze this document and visit the institution in order to fill out evaluation forms to be later analyze by the evaluation group and later on grant accreditation. Two programs have been evaluated, UPICSA in Mexico city for Industrial Engineering and University of Yucatan for Civil Engineering.

Accreditation is given for the time given for accomplishing the program's title (about 4.5 years) when the minimum general, and particular requirements are covered. In the event of detecting that one or two of this minimum requirements are not covered but the particular ones are, accreditation is given for two years, after which this particular problems are once again analyzed by CACEI evaluators. If the minimum requirements are covered but the evaluators find problems on covering the particular requirements, the accreditation term is determined by the evaluation team; when this term is due a new revision of the problematic issues. If the problems are not solved no accreditation is granted.

One of the main concerns of CACEI refers to the amount of engineering schools that are potential candidate for evaluation. There are 870 engineering and technology programs offered by 216 schools in Mexico². These numbers are useful for establishing the dimension of the problems. It must be said that until now there is little experience on doing external evaluations in Mexico, some of the them have been implemented at private institutions such as the Monterrey Technologic (ITESM) and Universidad Iberoamericana. Some others at the public sector, have been using experimental standards developed by the Ministry of Public Education. However the overall number of feasible evaluators is low.

ENGINEERING PROGRAMS EVALUATION AT UNIVERSIDAD IBEROAMERICANA

Universidad Iberoamericana Educational System is a private catholic system formed by five campuses distributed at Mexico and recognized by the Ministry of Public Education. The main campus was founded on 1943, and has a population of 10,600 students from which 2,600 are registered on a bachelors program at the Division of Science and Engineering.

Universidad Iberoamericana (UIA) seeks excellence at all of the professional degrees that are offered. At the Engineering programs the main importance is the lecturer himself. Nevertheless special attention is given to curricula by four means:



1) Academic freedom to teach and research: UIA establishes basic requirements for each course but the lecturer is free on the way he teaches and other topics that could be included. This way new interesting topics are continuously inserted in the curricula. This process is supervised and evaluated by a program coordinator in order to control the overall quality of the engineering degree.

2) Hands-on experience: This is one of the main concerns of the engineering programs and is enforced by means of laboratories, workshops, demonstrations, and work field experiences among others. The academic departments have operational and development plans to guarantee that the student obtains an experience that will be significant and useful when he/she works.

3) Lecturers evaluation: Students fill out evaluation forms in order to establish their opinion about the lecturer and the course itself. This is evaluated by the Academic College of the Engineering program and suggestions are given to improve the quality of the lecture.

4) Curriculum evaluation: This process is done every seven years with the objective of analyzing the program as a whole and establishing means to increase the quality of the engineering program. This results on changes to the basic aspects required for the courses, major curricular modifications and development plans for the degree. The first two aspects must be registered at the Ministry of Public Education in order to be recognized.

Other different processes are applied to control the quality of the students such as, admission minimum requirements and examinations; maintaining an average over a minimum quality standard for every semester; develop a thesis and present a final professional individual examination in order for the degree to be granted.

As can be observed this process is only concerned with an internal evaluation. In order to obtain a broader perspective, the Division of Science and Engineering counts on alumni and an Advisory Council formed by distinguished engineering and science professionals from Industry and Research institutions.

AN EXTERNAL EVALUATION AT UNIVERSIDAD IBEROAMERICANA

The Advisory Council of Science and Engineering at UIA was in charge of identifying the model to be followed for evaluation using international requirements. The moment was ideal ever since UIA was in the process of implementing a curriculum evaluation and so the results could be useful in order to be prepared for future educational constraints. Based on the council's advice, in agreement with the Dean's opinion, it was decided to apply the schemes proposed by ABET.

The bachelors program participating in the process were: Chemical Engineering, Civil Engineering, Mechanical Engineering, Industrial Engineering, Electronic Engineering, Biomedical Engineering and Physics Engineering, as well as the Mathematics, Physics and Computers departments who form the Division of Science and Engineering.

The project relied on the President's support and was coordinated by the Dean's office beginning on June 1992 and ending one year later. This involved counting on the advice of two distinguished ABET evaluators, preparing the documentation, implementing the visit of the consultants to the UIA campus, analyzing the results and establishing decisions toward the process. The people involved in the process were Department Directors, Heads from the different engineering programs as well as different administrative and services directors and coordinators from the university.



Some recommendations were obtained from the process referring to the following aspects: Strategic Planning, Reinforcing the use of computers, increasing internal communication and renewing some laboratory equipment.

Some other aspects were as well observed such as an outstanding effort for teaching humanities at the engineering programs, a good working environment for the faculty with some particular rotation at highly industry demanded programs, having a good library and counting on good overall facilities.

Broadly speaking the evaluated programs were detected to be traditional, having a good perspective for development.

Since June 1993 until now several actions have been taken regarding the evaluation such as increasing faculty salaries, updating computer equipment, developing the internal networks as well as a private network for all of the five Universidad Iberoamericana campuses, encouraging the use of networks as well as establishing an internal on line data base library service. Some other recommendations were as well easily implemented for the 1995 new programs obtained from the overall curriculum evaluation. However most of the recommendations had been detected by the university departments before the external evaluation, nevertheless the process was useful to ratify decisions and include some other perspectives.

It must be remembered that this was the first external evaluation experience at UIA, this fact itself offer some other interesting results such as reinforcing the working environment at the Division of Science and Engineering; increasing interdisciplinary work for research and teaching purposes; acquiring a better knowledge of our strengths and weaknesses referred to ABET standards; finally it has been possible to identify some other Jesuit universities at the USA that cover ABET requirements. This has been particularly interesting ever since new options for exchange programs have been opened and are actually exploited.

Based on this experience UIA has been very active at some of the main evaluations effort that have been developed at the country, such as CACEI and another one by Federation of Mexican Private Institutions of Superior Education (FIMPES) where UIA is a pioneer. The FIMPES evaluation system is already been applied at UIA, this evaluation scheme analyzes the institution as a whole but does not go into detail regarding bachelors programs, as CACEI does.

CONCLUSION

Mexico has been concerned with the quality of education trusting on the capacity of the registered educational institutions and programs in Mexico. However the system used by Mexico does not permit actual compatibility with the USA or Canadian system, resulting on difficulties for exchanging students as well as presenting barriers for the Mexican professional at the NAFTA countries. Accreditation actions could be useful on solving this problems.

CACEI is the main effort done by Mexico to establish an evaluation and accreditation system that will guarantee the quality of the engineering programs. Different actions have been taken to develop the system, however still in the process of self evaluating its own criteria on 1997. One of the main concerns that arise from the system is on the number of evaluators required, a strong effort is still to be expected on this direction.



One of the main consequences that CACEI may offer is guaranteeing quality from the different engineering programs. However, the actual economic situation of private and public institutions is not the best in order to correct problems or even establish developing programs. This is particularly important at the Engineering degrees ever since hands-on experience is one of the main components for education.

Finally it can be said that there are efforts done at Mexican educational institutions towards quality assessments programs as well as participation on the evaluation and accreditation efforts in Mexico. These institutions are the ones that will offer a broader development perspective for their students. Universidad Iberoamericana has always move on this direction.

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BIOGRAPHICAL INFORMATION

L. F. Borjón was born in 1962. He received an MSc. degree from Brunel University (UK) and the BSc. degree from Universidad Iberoamericana . On 1994 he was awarded the Best Masters Thesis on 1991 from the United Kingdom Institute of Measurement and Control Mr. Borjón is Assistant to the Dean of Science and Engineering and lecturer at the Electronic Engineering program at Universidad Iberoamericana. He works on the development of Instrumentation projects . These are related with sensors, data acquisition and programmable logic controllers. As an assistant to the Dean, Mr. Borjón works on accreditation issues, establishing relations with Industry and supporting technological applications at the Division.

F. Martín del Campo received the M.Sc. degree from University of Kent at Canterbury (UK) and the B.S.E.E. from Universidad Iberoamericana at Mexico City. He has been a member of the Mechanical and Electrical Engineering faculty at Universidad Iberoamericana since 1974. He was awarded The INDETEL Electronics prize in 1982. He has been project leader in the medical electronics equipment development sponsored by the National Council of Science and Technology (CONACyT) and Técnicos Electromédicos. He was Chairman of the Mechanical and Electrical Engineering Department at Universidad Iberoamericana (1986-1994).He served as Regional vice-president of the National Association of Engineering Schools. He currently serves as Chairman of I.E.E.E. Education Chapter, Mexico Section, and the E.E. Technical Committee at Council of Accreditation for Teaching Engineering (CACEI)

