

Assessing the role of mechatronics engineering, based on it graduate profile by knowledge areas.

Category: Quality assurance engineering education

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INTRODUCTION

The higher technological education is vital for modernization of any social environment.

In particular, the educational services provided by the Instituto Tecnológico de Estudios Superiores de la Región Carbonífera (ITESRC) in Coahuila state, are based in some feasibility studies. Most of them are executed by members of management and the teaching staff, according to the career where they are assigned to.

ITESRC has five careers to offer: Industrial, Systems, Electromechanical, Administration and Mechatronics engineering.

These investigations were developed with the purpose of analyzing the conditions in the geographic region that this paper describes, for ensuring adequately the needs of professionals which can be incorporated into the productive sector.

This fact, according to one of ITESRC main goals: create a final professional highly qualified to respond appropriately to society necessities, also being a student with a high degree of efficiency, with technical and scientific development abilities and aware of technological advances.

It identifies the special necessity to provide good professionals according to current needs. **(1)**

Nowadays, companies look for reducing and optimizing maintenance costs; mainly for expanding their levels of operation, through the use of technologies and innovation processes, and also doing design and reengineering at low cost.

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Perhaps the above items sound cold, they are only numbers. But they are intrinsically related to the human factor, because it is through the support of items like maintenance costs and research capabilities, as the organization gets its goals.

The role of higher technological education is to provide the productive sector, with professionals highly qualified. Students must be able to manage, to operate and to maintain automated processes; the control computer processes, or also for managing them.

Processes normally are associated with design, development, implementation, maintenance and to give service to specialists; among others.

This paper shows the efforts made by those who designed the mechatronics engineering, and the importance to assess the degree of requirements satisfaction on the productive sector.

A cross-sectional study to point out to the ITESRC about what kind of graduates of mechatronics engineering, the companies need and if they are receiving the most adequate students for the jobs offered.

In general, the productive organizations are created with the purpose of profit, so it is asserted, they need to optimize their financial resources and their available technical means.

The majority of the companies have a modern infrastructure integrated by automated equipment with hybrid technologies, using some processes of mechatronics, mechanical, electronic, industrial, computer and computer systems administration.

Therefore highlights the necessity to incorporate students well trained and trusted, to submit proposals for modernization for achieving the use of current technology.

Graduates of Mechatronics Engineering have the opportunity to compete and thrive in the productive sector; all they learn in their classrooms and when they work in some actual practices it is imperative to be at the forefront of new technologies and new methods.

Mechatronics Engineering has a specific contribution for society: to complement the training of its students teaching topics like process automation; being precisely this area, which has become an essential mean to improve performance and the effectiveness of the operational functions of a modern industrial enterprise.

Some expectations for a good student training are:

- To purchase leadership skills.
 - An enterprise vision for solving and preventing problems.
 - To perform innovations in production and service sectors.
- To manage human, material and financial resources optimally

It is important to mention that about 70 percent of Mechatronics Engineering students are working on part-time jobs at companies in the geographic region in which is located the Institute, developing works like operator; thereby opening up possibilities to grow professionally within those companies.

The focus of the cross-sectional study aims to determine what so similar is the graduate profile with the desirable professional profile of the enterprises.

If both profiles are not similar in high percentage, the mechatronics engineering does not achieve the expected social impact and therefore is not helpful to the productive sector.

METODOLOGY

The ITESRC performs some actions for developing the skills of their students, to be incorporated easily into the productive sector.

Particularly we analyze efforts of the career of mechatronics engineering with specialization in processes automation, to know the demands of different organizations, in the exercise of their specific activities.

The activities that are structured to evaluate the satisfaction degree of social and work environment where graduates are normally hired are:

- To apply the technique named focus group, researchers gave appointment to several companies that hire graduates from the mechatronics career of ITESRC, in order to know their most pressing needs.
- Of the companies with appointment, only came seven representatives, all of them want to stay anonymous.
- Researchers from ITESRC show to the attendees the importance to have good communication between them and the Institute, in order to fix any deficiencies that any student could have, before enterprises hire him.
- ITESRC is worried about if their graduates of mechatronics specialized in process automation, are properly capable to satisfy necessities from enterprises who hire them.
- Next, ITESRC applies a survey where entrepreneurs express with their answers, the main points they need of the graduate profile of mechatronics, contrasting each one with their actual requirements.
- It is requested to potential employers of future graduates that mention some other aspects where they recommend adjustments or additions to enrich the curriculum of the mechatronics career.
- The surveys are tabulated by category, to see the overview presented by the sample.
- Subsequently, a new table is created, where aspects of the graduate profile are categorized by knowledge areas, to determine which of them require a considerable improvement.
- Each aspect is calculated based on the results of affirmative observations between the total sample size.
- Finally the average percentage is obtained.

Following are the tables that contain the results of the comparison of before mentioned, in order to visualize the positioning and impact of the race, within the society.

This contrast is presented through a cross-sectional study, first with General aspects, and then with a classification by areas of knowledge.

Cross-sectional study in general. Comparison of profiles.

Table 1 shows the results of the questions made to seven companies that have agreed to provide their information, for the analysis of the profile of mechatronics engineer with desirable professional profile.

Table 1. Cross-sectional study

#	ASPECTS EVALUATED	DESIRABLE PROFILE	MECHATRONICS PROFILE	ENTERPRISES WHO AGREE WITH ASPECT	% PROGRESS
1	<i>Practice their profession within a legal framework</i>	X	X	7	100
2	<i>With sense of social responsibility</i>	X	X	7	100
3	<i>Agree with national and international standards</i>	X	X	7	100

4	<i>With the ability to analyze, synthesize, design, simulate, build and innovate products, processes, equipment and mechatronics systems</i>	X	X	6	86
5	<i>Attitude research, according to the current and emerging technological and social needs</i>	X	X	5	71
6	<i>That you seek to have a positive impact on the global environment</i>	X	X	5	71
7	<i>That integrate, install, construct, operate, control, maintain, manage or to automate mechanical systems</i>	X	X	7	100
8	<i>Use technologies electrical, electronic and computational tools to automate mechanical systems</i>	X	X	6	86
9	<i>Evaluate and generate industrial and social projects</i>	X	X	6	86
10	<i>Able to coordinate and guide multidisciplinary groups</i>	X	X	4	57
11	<i>Fostering teamwork for the implementation of mechatronics projects</i>	X	X	6	86
12	<i>Capable of ensuring the quality, efficiency, productivity and profitability with a sense of responsibility for their social, cultural environment for sustainable development</i>	X	X	5	71
13	<i>To develop skills in leadership, communication, personal interrelationships to convey ideas, facilitate knowledge, work in multidisciplinary teams</i>	X	X	3	43
14	<i>To show collective responsibility for solving problems with a critical and self-critical.</i>	X	X	6	86
15	<i>Creative, entrepreneurial and committed to his professional updating continuous and autonomous, to be at the forefront of scientific and technological changes that are given in the exercise of his profession</i>	X	X	4	57
16	<i>Being able to interpret technical information from the areas that make up Mechatronics Engineering</i>	X	X	6	86
17	<i>That have ability to develop simulations and innovation of cutting-edge technologies</i>	X	X	6	86
18	<i>Mastery of a foreign language</i>	X	X	5	71
19	<i>Who knows another language besides English</i>	X		0	0
20	<i>Training in the management and administration of human resources, leadership and values</i>	X	X	4	57

Analyzing the overall cross-sectional study on table 1, it is showed that only the aspect 19, which the domain related with knowing an additional language to English, has a zero percent compliance.

Employers point to the importance of the domain of other languages, because of the need to interpret or operate machines or electronics from other countries, with directions in German or in French, to give some examples.

Perhaps a much more significant sample with the same response will motivate the institution for establishing at least, some courses about foreign languages.

The above, because there are many skills that students must acquire during his professional instruction, and they do not have enough time to do so.

DISCUSSION OF RESULTS

It is defined initially as profile of a mechatronics engineer:

- To practice their profession, within a legal framework, having a sense of social responsibility, agree with national and international standards.
- To analyse, to synthesize, design, simulate, build and innovate products, processes, equipment and mechatronics systems, with a research attitude, according to the current and emerging technological and social needs, impacting positively on the global environment.
- Integrate, install, build, optimize, operate, control, maintain, manage or automate mechanical systems using technologies electrical, electronic and computer tools.
- Evaluate and generate industrial and social projects.
- Coordinate and guide multidisciplinary groups fostering teamwork for the implementation of mechatronics projects, ensuring their quality, efficiency, productivity and profitability with a sense of responsibility for their social, cultural environment for sustainable development.
- Develop skills in leadership, communication, personal interrelationships to convey ideas, facilitate knowledge, and to work in multidisciplinary, multicultural teams with collective responsibility for the solution of problems and development of projects with a critical and self-critical.
- To be creative, entrepreneurial and committed to his professional updating continuous and autonomous, to be at the forefront of scientific and technological changes that occur in the practice of his profession.
- To interpret technical information from the areas that composes the Mechatronics for the transfer, adaptation, simulation and innovation of cutting-edge technologies. (1)

According to the general cross-sectional study, the career of mechatronics engineering with specialization in process automation has good results in 75% of the aspects presented.

It is needed some improvement in those aspects the employers gave bad score.

Analysing the situation by areas of knowledge, there are some findings related to the desired profile we show below.

They give a percentage of accomplishment of mechatronics from ITESRC with the productive sector.

- Engineering Sciences: 80%
- Social Sciences: 83%
- Applied Engineering: 79%
- Other Courses: 43%

The representatives of surveyed companies appoint as critical aspects mainly:

- The development of the skills of leadership and the management and administration of human resources; setting that affects the area of social sciences.

- Related to other courses, that show low percentage compliance, it is essential to make adjustments to the study plan.

Some of the aspects included in other courses and that need to be improved are: mastery of English as a foreign language, courses in leadership and human resources, the domain of an additional language besides English, for example German, and basic knowledge of copywriting and professional reports.

The reasons for their responses are subject to the needs of knowledge and skills with which entered its companies, graduates of the ITESRC.

DISCUSSION OF RESULTS

The results presented are clear and undisputed.

Who better than own employers to evaluate the degree of compliance with the profile of mechatronics engineer, and also compare it with the actual needs of skills and knowledge?

With 75% global compliance, it is concluded that the speciality of process automation is the appropriate and the required by the society.

Perhaps the sample is not very large, because only a few employers attended the request of information; but it shows the overview of the productive sector.

It is worth to mention that to open additional courses that benefit students, the ITESRC must develop a feasibility study for each one, to assess its acceptance into the productive sector.

The generated costs to establish the teaching of a foreign language are high, the need to hire staff specialized on it.

The settings that are possible, and almost immediate application, are those of applied engineering, engineering sciences and social sciences: a study of plans, according to the topics covered, will be very useful to the administration of the career. Perhaps some teachers may require a further strengthening in the subjects taught, to give a fulltime professorship.

A feasible solution, whose application has been previously given, is the recruitment of a specialist, for the teaching of a seminar by discipline.

As we can see, the graduate of mechatronics should learn everything is within his reach, for purchasing the set of skills that the Institute wants to provide.

The effort of the Institute continues, through research like this; it has as a purpose, enrich the process of formation of engineers.

What is not measured is not controlled, so the ITESRC is constantly in a State of continuous improvement of its processes.

Evaluate the training process in the career of engineering in mechatronics, makes up the first step towards obtaining educational excellence at the top level. And it will be progressing.

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