

THE PROFESSIONAL TRAINING STAYS AT THE ESIQIE-IPN-MEXICO : A Rapprochement Between College & Industry.

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Abstract. *Engineering students of the sixth and eighth semester at the Escuela Superior de Ingeniería Química e Industrias Extractivas (ESIQIE), curriculum of the Instituto Politécnico Nacional (IPN), carry on a practical training in national industry facilities for a period of one month. The purpose of this training is to get in touch with the productivity sector where they will develop their professional skills. Officially, this practice is called "Professional Training Stays" (PTS) and it was implemented a long time ago at the ESIQIE, around 1945, when the Instituto Politécnico Nacional of Mexico was founded. However, as far as we know, there are no previous studies concerning the requirements and limitations of the PTS program, which led the authors of this paper conduct some research on this subject. Thus, the purpose of this work is to study all factors influencing the PTS program such as the following : management, technical, curricular, normative and those related to the college-industry links. As important results of this PTS evaluation, there emerged suggestions about how to improve the students practice in industry, in order that ESIQIE take advantage of the existing bonds as well as establish new forms of relationship between the university and enterprises.*

Introduction.

The authors of this work, some years ago, have belonged to the board teachers in charge of the scholastic practice evaluation that students of the Chemical Industrial Engineering career (CIE) accomplish in various industries and service centers associated to different enterprises. Through this experience, it has been observed that the practice of the Professional Training Stays (PTS) is a fruitful activity for students. However, it is important to research for information that permits us to evaluate the PTS in order to investigate the possibilities for increasing its quality. Over all, this objective is particularly relevant when, one considers the wide experience that ESIQIE has in this activity.

It is important to point out that in order to attain the above purpose it was necessary to involve different aspects

which include those academic, technical, normative and management parameters related to the link university-industry. Thus, in this work we consider the specific stages associated with the relationship existing between ESIQIE and the various enterprises that customary accept students for the PTS. At this point, it should be noticed that a preliminary evaluation of the PTS in relation with its precept, its historical development and the performance of the students in the industrial companies was already given. However, it was necessary to systematize the PTS information in order to know about the relevant parameters to be considered with the aim to have a close and advantageous approach for both ESIQIE and industry. That is, in this work we are concerned with the analysis of the administrative, technical collaboration, support to students and other variables that were considered with the purpose to understand its influence and decide how to modify them to improve its role into a better PTS program. For that, the description of what currently happens is based on the experience of the teachers or instructors, as well as on some instruments applied to the students for such purpose, on the organization of practices at the ESIQIE, on the reviewing of practice's reports, on the evaluation's sheets, on the regulation rules and on the interviews.

Based on the investigations and results obtained in this work, we provide some proposals that can be useful for the assessment, control, evaluation and improvement of the present and future relationship between college and the entrepreneurial sector through the PTS ESIQIE's program.

Historical Development of the PTS Program.

From the establishment of the scholastic practices at the ESIQIE, they have gone through different status. During the period elapsed from 1945 until 1949, the ESIQIE's practices had optional character and they were covered at the ending of the fourth and fifth years of the engineering career : one-month duration by year in each case. Thereafter, they were converted from optional to mandatory during the fourth and fifth years of the engineering curriculum at the time that

they were established as support materials for the Processes Analysis I and Processes II subjects. That is, to complete or credit these subjects, the students were required to qualify the PTS by means of a practice's report appraised by the teacher responsible of the mentioned class.

In 1975, the ESIQIE's curriculum changed from annual to semiannual and the professional training stays were converted to subjects. In consequence, since then and to date, they appear in the certificates as credited or not credited which means that they were satisfactory accomplished or not accomplished. It is important to notice that this change of status for the PTS mark a great advancement in the usefulness of the professional practices because of two principal reasons : a major interest shown by students to fulfill the PTS and an increase of grant support provided by the National Polytechnical Institute (IPN) of Mexico.

Actually, the scholastic practices are curricular activities that should be articulated with other activities as part of its learning contents. To that end, there exist activities that include the execution of industrial visits that students accomplish in the first and fifth semester. However, in spite of the advantages derived from this practice, some problems in planning and scholarship management have appeared. For example, even though the PTS has a mandatory curricular character, the college can not guarantee a place in the enterprise for each one of the candidates. In consequence, the students have the responsibility to obtain their own practitioner status in the season during which the school considers they should accomplish this activity.

On the other hand, there exists a certain contradiction between the scholastic practices definition and their installation in the ESIQIE : the Regulation of Practices and Scholastic Visits of the Professional Studies Direction [1] and the internal regulation of the National Polytechnical Institute (IPN) [2] considers the PTS as a support to certain subjects. Besides, as mentioned before, the PTS are included in the certificate as mandatory matters with all the consequences derived from the scholar management of the industrial engineer career. Thus, at first instance it doesn't appear congruent that the PTS are considered as support for other subjects and additionally as a subject as well.

Also, even though the head of Visits, Practices and Title Department (VPTD) assigns the responsible person for verifying the accomplishment of the PTS and its qualification, there doesn't exist an academic instance in charge of the assessment of such activity. Furthermore, usually these teachers do not constitute an academic presidency for which there is no academic work of group to be done. In fact, the instructor informs the student about the objectives of the PTS, gives them instructions on the residence's features and the outlook about the content that the report to be presented should have. Also, it is important to notice that reports evaluation criterion depends on the teachers that pursuit the development of the PTS ; i. e. there

result that there can exist as many evaluation criteria as teachers are designed to the individual PTS practices follow up.

Finally, it is important to mention there is neither exist a formal academic link between visits to the industry (and naturally with the PTS practices) with the rest of the subjects that conform the curricula of the engineering career.

Features of the Current Relationship Between ESIQIE and Productivity Sector

At the enterprise, there exist a specific entity created to the supervision of students and which is in charge of answering a questionnaire that inquires about six special topics : knowledge, discipline, cooperation, responsibility, initiative and sociability of students in order to promote the quality in their practice. In this respect, although the indicators and answers provided by the entrepreneurs are not very clear, in all cases it is observed that 90% of students obtain qualifications of A and A+.

In the next section, we show the method and results obtained in the detailed analysis of 34 reports of PTS presented by students of the seventh semester of the Industrial Chemical Engineering career that correspond to the scholar period 96/1.

Methodology

In the evaluation of the PTS we considered the following two aspects : a particular interest about the documentation provided in order to give response to the previously outlined objectives and a focus on the observations and proposals that students make about the industrial enterprises where they applied.

In relation to the first point, the industrial sector uses sheets of evaluation where they qualify the student's social behavior within the occupational field ; as a result of the analysis of the different evaluation sheets one found a 92% of efficiency respect to the behavior of students in non-academic aspects.

Concerning with the second point, the students must provide a report of their PTS practice containing the following information:

1. Nature of the company.
2. Location of the enterprise.
3. Activities accomplished by students.
4. Important deficiencies detected by the students while they were involved in the PTS practice.

Results

As was mentioned previously, the reports of the PTS practices analyzed were those presented by two groups of 34 students, each time, of the seventh semester, morning shift, of the Industrial Chemical Engineering career, presented in December 1995 and that corresponds to the 96/1 semester.

Table 1. - Nature of the industrial branch where students carry out their PTS practices.

Industrial Branch	Students PTS Assistance (%)
Nutritional	22
Services and Marketing	13.2
Cosmetic and Perfumery	11.8
Paintings	8.8
Polymers	7.4
Water Treatment, Mining, Electroplating and others	36.8

We mentioned before, that upon analyzing the information of the various evaluation sheets, it was observed that 90% of the training students obtained qualification of A and A+. However, it should be pointed out that always result recommendable to continue in the design a evaluation sheets in order avoid misinterpretation of them, which could make that their analysis led to non-valuable conclusions. On the other hand, in relation to the information presented by the students in their PTS reports, Tables 1 to 4 shown the data related to the specific characteristics described in above section.

Table 2. - Location of enterprises by zones of PTS practices

Zones of PTS Practices	Distribution (%)
Metropolitan sector : Federal District and Mexico State	88
Interior of the Country	12

Table 3. - Activities Accomplished by Students

Type of Activities	Percentage
Quality Control	53.4
Production	8.7
Environmental Audit	7.4
Security, Hygiene, Environmental Advisory and Environmental Projects	30.5

Table 4. - Important Industrial Deficiencies Detected by Students*

Industrial Deficiencies
Lack of Security and Hygiene
Insufficient Personnel Trained
Ancient Laboratory and Obsolete Production Equipment
No Suitable Maintenance
No Formal Quality Control Programs (In small industry)
Communication Problems Between Different Departments
Nonexistence of Growth and Modernization Outlines

*) Most of the industries visited by students were small.

Proposals for a Better Rapprochement Between ESIQIE & Industry through the PTS Practices.

Using the above information, presently we are engaged in the design of a data base and its management software with the objective to permit the VPTD to collect information to make a follow-up in relation with the industries concerned with the PTS student practices. With this data base, which will contain information on the enterprises interested in knowing about the undergraduate and graduate students, we pretend to improve the profile of the undergraduate students with a tool that permit them to make a better choice of the industry where they desire carry on the ESIQIE's PTS program.

Thus, the information that it is necessary to capture, in the data base, with the objective to make it useful for the college and for the enterprises can be summarized in :

- *Industrial branch, Firm or trade name, Location and Size* : This parameters are usually considered as auxiliary enlightenment because they are used to determine the

profile of enterprises as well as the students preferences. Specifically, with the knowledge of the location and size of companies it is possible to establish the industrial zone where they are founded, its distribution and its probable infrastructure.

- *Block diagrams of processes or procedures* : This information permits us to know the types of processes on which the companies operate at present, as well as to have knowledge about the procedures established by some bureaus and advisory promotional offices that offer their services.
- *Technical deficiencies detected by students* : We consider that this information is useful for ESIQIE since it permits academies to know the strengths and weaknesses of the industry involved in the PTS program.
- *Number of students that different companies accept* : Straightforwardly, with above data it is possible to establish the availability of the company to accept students.
- *Availability of spaces where students will accomplish their activities within the industrial enterprise* : With this estimates, the aim is to determine if the work accomplished by students is in agreement with their academic training.
- *Number of students incorporated to the company as regular workers, for social service activities or granted for thesis work* : Conversely to the above case, the purpose of this information is to recognize if the profile of students is in good agreement with the needs of the different industrial enterprises.
- *Services and presentations that the company offers to the students* : The data we are interested in are related with contingent contracting, scholarships, travel allowance, nourishment and lodging. All this Information is required to know which are the possible supports that the company grants to the accepted students.
- *Duration of the PTS practices Company's request* : Even though planning of professional training stays on the part of the school has a minimal pre-established duration there exist companies that require the students to stay over a wider period.
- *Type of work that demands the company for the PTS* : These can be of different nature ; research, project management or service. Besides leading to a better PTS program, this information will serve as a useful school

tool to be used in the search of solutions to the needs of the different industrial enterprises, particularly in those matter concerning technical support.

Although all the above items are essential to promote and improve the PTS student's practice, they are not enough. Also, it is necessary to encourage the implementation of informative meetings between the VPTD and the different groups of industrialists and associations of them in order to make them knowledgeable about the PTS program by focusing on the relevance to the college and students as well as on the benefits that such a practice entails for the companies where students have acceptance. Also, it is important to establish and keep contact with ESIQIE's graduates in order to disseminate and motivate the PTS practices within the occupational field of their own.

In short, with the above proposals it will be possible that the Visits, Practices and Title Department of ESIQIE can elaborate an industry folder where information related with the request of students for the PTS practice program is available. That is, systematizing the information is essential to carry out the evaluation and assessment of students and industries involved in the ESIQIE's PTS practice program as a useful alternative to other mechanisms used for the practice-based engineering education.

Concluding Remarks

Due to the fact that graduate students of the ESIQIE have for the development of their professional skills, diverse enterprises involved in the industrial activity, it is important that students have a previous contact with these companies in order to locate them in the reality of their future occupational context. Therefore, is desirable that the ESIQIE makes an additional effort to improve the professional training stays practice program.

Also, as pointed out in previous sections, the PTS practices offer many possibilities for a better rapprochement between the ESIQIE and enterprises of an ample industrial sector of manufacturing, processing, development, research and, why not, academic sector of both fields : government and private business. For that, we suggest a greater link with industry in order to know more intimately of its problematic, specially those of the micro and small industries with the objective to provide solutions through the PTS practice program offered by ESIQIE. At the time, this would allow us to a closer look at the performance of the students and the opinion that industrialists could have on the industrial engineering program.

The mutual help can be channeled through the elaboration of thesis, social services, special studies, services, an many other occupational activities in accordance to the principles that gave rise to the IPN.

That is, today more than ever it is necessary that colleges achieve a double effort to get a greater of link with the productive sector, through advising and consultant services at the time that is imperative to update the courses and engineering programs that university can offer.

In the specific case of the PTS practice program promoted by ESIQUIE, even though practices have proved to be useful to the students, school and industry, there are various operative problems related with the scholastic management to surpass. Besides, it is necessary that ESIQUIE define the norm that should be applied to the PTS practices in order to eliminate contradictions. Assuming that professional training stays would considered as subjects, it is recommended to organize an academy to define and advise

the corresponding schedule during the semester that is in concordance with the accomplishment of the PTS practices.

Bibliography

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