

Innovative Measures to Improve Performances and Supervision in Post-Graduate Studies

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Summary

The universities of most industrialized countries of the world are presently confronted with at least three specific problems in regards to the development of post-graduate education: the decline in clientele, the insufficiency in the rate of degrees awarded and the prolongation of the length of studies. The number of students that register is insufficient to maintain the activity of the past decade and when they persevere to continue their studies it is often at an unsatisfying rhythm. In the province of Quebec, the financing universities is attributed according to specific formula that does take into account these different parameters, So we do not have any choices, we must be imaginative and quickly find solutions in order to improve our performances.

After considering this problem, it became obvious that we must primarily improve our own functioning in order to enable us to render our programs appealing and help students to improve their efficiency. The object of this communication is, therefore, to describe the innovative measures that we have taken in order to improve our performances and the supervision of our post-graduate students.

1. An Evolving Situation: Enrolment, Rate of Degrees Awarded and the Length of Studies

In the last ten years, the development of post-graduate studies has shown a rapid increased followed by a decline observed in the last two years. The future leaves us with three main problems: the decline in clientele, the insufficiency in the rate of degrees awarded and the prolongation of the length of studies. Such an evolution has a direct impact on our resources and as a consequence we can no longer manage our establishments in the same way and there is a risk deteriorating performance. By way of example, a publication in Prism in September 1995, entitled SOFTENING ENROLLMENTS, clearly note the decline of clientele in the engineering programs in the United-States: "Survey results revealed that full-time undergraduate enrollment in engineering dropped almost 3 percent from 337,817 students in fall 1993 to 328,463 students in fall 1994. This decline (1 percent steeper than that of previous year) occurred more or less evenly across all undergraduate levels of enrollment, with the number of first-year students dropping the most - approximately 4 percent to 85,047 students. (...) Full-time graduate enrollment in engineering declined for the first time in more than 10 years. It dropped over 5 percent to 74,596 students, reflecting a reduction in the number of foreign nationals (residents of other countries) enrolled."(1).

In Quebec, we have noticed the same pattern in all the cycles of studies. And at **École Polytechnique** the same situation prevails. If we look at some recent figures, it clearly shows the clientele of full-time undergraduate enrollment in engineering dropped almost 12% from 3704,60 students in fall 1992 to 3262,73 students in fall 1994.



The equivalent full-time graduate enrollment in engineering increased regularly since 1994 but dropped from 859.39 students in fall 1993 to 835.83 students in fall 1994,

As for the situation regarding the rate of degrees awarded, it does not seem much more brighter. Certainly, the rate of degrees awarded in **first** cycle studies is more stable: the students study full-time and have a more structured and supervised development, which allows them to finish their studies in an almost identical lapse of time (9 trimesters). But the situation is not the same for research master or doctorate students: many of them abandon during their studies, those who persevere take a lot longer time than is desirable to obtain their degree. In fact, the evolution of the number of master and doctorate degrees does not progress at a rhythm that reflects the evolution of clientele of the past few years, neither the average of the length of studies. For example, by observing our group of degrees of 1994-1995 (236 level master degrees, 50 Ph.D. degrees), we notice that our graduating students have a length of studies of more than seven trimesters for the master and of more than 13 trimesters for the doctorate.

The evolution of the situation regarding the development of post-graduate studies maybe explained by: the fact that graduating students from the first cycle are decreasing therefore decreasing our potential clientele; young graduates in engineering hesitate to enrol in post-graduate studies that will delay of many years their arrival on the labor market where the actual conditions are already disquieting; and those who have the courage of undertaking masters and doctorates programs abandon in great numbers or do not get out of the education system, with their degree in hand, at a satisfying rhythm. Therefore, we must be more imaginative in order to improve our post-graduate training system.

An other important element that we must consider when analyzing Quebec's situation is the financing mode of universities. The politics and practices of the Quebec's provincial government see that the financing of universities is attributed mainly in regards to the number of students enrolled in programs at full-time, while considering some parameters regarding the length of studies. For example, for students enrolled in research training programs, the government assures the grant for a limited period which is way below the average length of studies: four trimesters financed at the master, while the average length of the **École Polytechnique** is around seven trimesters and eight trimesters financed at the doctorate, while most of the students finish after thirteen trimesters or more. Furthermore, the government now offers a bonus for each student that obtained a diploma at the end of his study program. Note that the grants taken to distribute this bonus has been taken from a constant **funding** envelop. These new governmental measures have as main purpose to prompt us not only to enroll students but to also make sure that they graduate in appropriate time. In brief, universities do not lack good reasons in order to be more imaginative and to find measures to improve their programs and their productivity.

2. Innovative Measures in Order to Improve Performances and Supervision in Post-Graduate Studies at l'Ecole Polytechnique

Faced with the evolution of the situation and the urgency to find solutions to the different problems that we identified, we have sought, then found innovative solutions in order to improve the performance and the social and economic pertinence of our programs, but also the supervising conditions of our students.

We made the wager that it is by improving our own functioning and our supervising measures that we will be able to render our programs appealing and help our students to increase their productivity. The measures or instruments elaborated in this context have been put in process over the last two years. They can be divided in three categories: the ones regarding the programs, the ones regarding the students and the ones destined to the professors.

2.1 Modular Masters : a New Structure in Order to Improve the Masters Programs

The first series of measures are in regards to the programs. This analyses made of the presentation of our program showed many deficiencies in many of our programs: lack of structure, poorly defined objectives that have nothing to do with the performances expected on the labor market and mostly, a course bank where the students can chose practically anything he wants, just as in a cafeteria. In close collaboration with the concerned department we primarily worked on a program description that was more explicit, on clarifying the objectives and finally presenting them in a more dynamic and appealing way. Therefore, in a first step, we thoroughly revised our *Annuaire* and its content.

Stimulated by these observations and following consultations with representatives of the labor market, that we have judged urgent and appropriate to find new formulas to allow the amelioration of the structure and pertinence of our masters programs. From this thought emerged the concept of modular masters, In practice, the modular master formula, which the content is mostly composed of courses (30/45 credits), is intended for engineers in practice who seek a more advanced training in their specific working field. These thematic, and generally interdisciplinary or even interuniversity, have a more technological and fleeting content than the traditional disciplinary masters. Furthermore, important characteristic, they often appeal to resources of other university establishments but also to industrial firm who help us with both the definition their content and even the teaching.

Their structure is the following: three 15 credits modules each having a function and well-defined training objectives. The first module, or basic module, is formed of mandatory courses and it's goal is to assure that the student possesses the advanced and required knowledge for the field of study at stake. The second module, also called specialization, has a more technological and specialized content and enables the student to acquire knowledge and more specialized skills in the aimed field. This module has a more variable content. The courses are grouped according to specific and different orientations, including very specialized courses and occasionally peritechnological courses. This module is conceived in order to allow a certain flexibility to the student whom will be able to make pertinent choices according to his career goals. The third module, generally called integration module, allows the student to realize supervised practical work either in a training form or in engineering project in industry, in the specialized field that this master has trained him for.

This program structure, other than being modular, also distinguishes itself from the traditional programs because it allows the student to receive an official recognition at each step of his studies. Thus, when the student has completed his basic module, he receives a certificate of success for this module; when he completes the second module, also called specialization, he receives a second certificate or a DESS diploma which requires 30 credits, if he decides to stop this program at this stage; on the other hand, if he continues and completes the third module, called integration, he will receive a master's diploma mentioning the specialization studied. This curriculum is structured to be completed in 18 months. We presently count eight modular masters structured according to this outline in the following fields: rehabilitation of urban infrastructures, electronic, computer science engineering, software engineering, logistic engineering, management of technology, composite material and material and others will follow.

2.2 The Modulation of School Fees and the Guide on Supervision : Measures Aiming the Students

2.2.1 The Modulation of School Fees

Quite obviously, our students enrolled in research programs do not always seem in a hurry to terminates their



study. Studying conditions and appropriate financing for those integrated in research teams with a extra financing, are often partly responsible: Therefore, we imagined a formula for the payment of school fees in order to make students and professors aware that studies too long implicate a non-financed cost for the establishment, and that he will, from 'now on, partly assume. Curiously, the students themselves agreed with this measure aiming the reduction of the length of studies.

In practice, this means that since fall 1994, school fees for students enrolled in research programs are modulated according to the financing modes of the government. Thus, we will receive a grant for the students for four trimesters at the master and eight trimesters at the doctorate. Therefore, the student pay the regular fee per trimester for the granted period and after that period the fees will be reduce for two trimesters (master) or three trimesters (doctorate), period during which he is considered in research writing. Once this period comes to an end, the student is imposed the regular school fees per trimester of study until his graduation. This measure made many student think and we noticed, in many cases, a decrease in the length of the writing period.

2.2.2 The Guide on Supervision : *For a Quality Supervision : a Communication Tool at Ecole Polytechnique*

Our student have been complaining for years that they do not know, or learn to late, about their obligations and responsibilities in the course of their studies, which implies that l'École and the study or research directors are not communicating very well. Many formulas have been considered, but after many unsuccessful trials, we published a guide in order to improve communication between the students and the professors.

This guide does not replace the rules or politics of the official documents of l'École. It is constructed as aide-memoire questions, it present to the student a inventory of facts and aspects that he must consider in order to benefit from a quality supervision during his studies. These questions are grouped under three headings. They first ones (16) call out directly to the student, the heading is titled Personal commitment and student's responsibilities/Engagement personnel et responsabilites de l'étudiant. For example, we can find in this section questions such as: Have I evaluated and planned my financial needs in order to pursue my studies? Or, Have I conceive my study plan such that it can be completed in a reasonable delay? The second series of questions (19), titled Conversation with the director of studies or research, include questions that allow the student to benefit from a quality supervision: has my director taken arrangements in order to integrate me in his group or his research team? Or, does my director plan to verify if I take note regularly and appropriately of my results? The third section contains questions (10) regarding supervision methods planned by the administrative units and is titled Conversation with the administrative units: Is an integration activity planned for my arrival at l'École Polytechnique? Or, What are the financing possibilities for a student enrolled at l'École as well as their politics on this matter?

This tool, aiming at the improvement of supervising conditions of the students and wrote by a team of teachers, students and administrators, as known a frank success ever since its publication in fall 1995.

2.3 An Incentive Measure for Professors in Order to Reduce the Period of Study

The described guide has obviously had an impact on the supervising performances of professors. Even though it was written for the students, many professors are using the aide-memoire to guide their discussion with their students. But this is surely not sufficient to improve to reduce the length of the study and increase the rate of degrees awarded. Therefore, we introduced a specific measure to motivate our professors to graduate their students in a reasonable delay.



In fact, at the **same** period as we introduced the modulation of school fees for students, we brought into force a degree bonus politic. A professor who graduates a master student in six trimesters or less, or a doctorate student in eleven trimesters or less, and recruit a replacement student immediately or during the next trimester, obtains a **grant** of \$ 1000 in his research account. This amount should enable him to give extra financing to another student an to maintain his activities at a **satisfying** level and rhythm. In the year following the introduction of this measure, we **have** granted more than 35 bonuses.

3. The Future and Innovations in Gestation

The programs, the students, the professors, there are the three targets on which we aimed in order to improve our performances. Some of our measures gave immediate results: increase in clientele in the masters programs for example. Others gave result after one or two trimesters, such as the degree bonuses. And others, we hope, will give results in a short lapse of time, such as the guide on supervision or the modulation of school fees.

Regardless of the results obtained through in force measures, we are working on new projects in order to find more innovative measures in order to improve our performances. Following, you will find at least three innovative measures:

- ▶ integrated programs where the student is well supervised in an accelerated study course in which he will obtain a master's diploma in one year: integrated bachelor-master's;
- the development of new teaching formulas with the help the new and available technologies;
- the development of made-to-measure masters and offered by intensive training periods for **executant** already in practice.

References

(1) LeBuffe, Claire, "Softening enrollments, enrollments '94", *ASEE PRISM*, Sept. 1995, pp. 35-37.

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