THE ESSENTIAL OPERATION'S MANUAL FOR THE INCOMING HIGHER EDUCATION STUDENT

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Abstract. *A two semester, one-hour weekly course was created in the first year of the Mechanical Engineering and Industrial Management graduation. It aims at coaching some skills that helps freshers dealing with the major challenges to be met at the beginning of higher education.*
It is three-fold: study techniques, relationship management and reading/comprehension. A set of individual interviews is made in order to select a reduced group of students, approximately 20 among 95 entries. The lower profile students are hold down. Several short assignments are distributed and their subsequent exposition encouraged among the group. The success of this initiative is to end up with a group of students able to address the main issues on an independent basis, so that in the end it helps them to learn and live their lives somewhat more effectively.

Keywords. *Engineering Education, Methodology, Effective Learning.*

1. Introduction

Portuguese tertiary education includes long and short courses, envisaged with the latter deemed as falling within the purview of a Polytechnic system. Only in the eighties, after the period of the Revolution, this system was implemented. The massive arrival of students, on one hand, and the need for an equivalent amount of teachers (which the country obviously did not have at the time), on the other, became a major hindrance to an adequate preparation of all those finishing high school and intending to enter higher education. The mentioned massiveness of the access to higher education was also accompanied by the development of society high expectations regarding those that accessed it, linked to an elitist logic from the past. The first year in higher education constitutes thus a critical period, where more than half of the students who initiate their studies show difficulties of adaptation, integration and accomplishment, translated into low rates, dropouts, change of course and course abandon. A set of variable interacts with the quality of the transition to that new educational context: from those more directly related with the learning tasks, to those concerning the personal nature and the psychosocial development and the specificity of the academia's context itself. Also, the Portuguese integration in the European Union has been demonstrating the ineluctable need for versatility, in order to cope with the innovative trends that are typical of today's economic activity. As a result, the institutions, particularly those in higher education, have to increase their level of adequacy (Simões, 1998), without lowering the required standards. The Mechanical Engineering and Industrial Management department considers this to be its fundamental challenge.

2. The Mechanical Engineering Course

This is the context where the Mechanical Engineering graduation, now established 13 years, has been making an effort to define a curriculum that allows the acquisition of sufficient knowledge and skills to fulfill a competent professional life. For this desideratum the existence of a Consultation Council has been decisive, as it is composed by representatives from public institutes and private companies and corporations and it has suggested corrections and changes, emphasizing some specific areas. On the other hand, this department boasts several staff members who also work in industry and who therefore can provide continual feedback. Furthermore, a 3-month training course was obligatory at the end of the studies to obtain the diploma, with assessment from both company and school resulting in a final grade. As the profile should not be limited to a technical component, aiming to achieve a long lasting education and the required flexibility in today's world, areas such as Materials Resistance, Thermodynamics, Fluid Mechanics and Electricity are considered as structurally underpinning the course, allowing individual learners to become creative problem solvers. The assessment of the required deep knowledge in these areas focused the first year as the beginning of the chain.

The school conducted several surveys since 1995, under the ambit of the internal assessment program, guided the Portuguese Board for Polytechnic evaluation. In all of the surveys the results of the Mechanical Engineering and

Industrial Management Department had a very high rating in items such as employer satisfaction, giving us indications along the same lines as those given by mentors of the students' work experience.

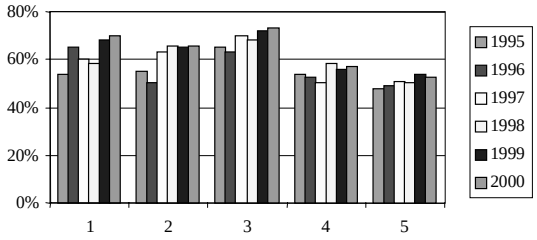

Figure 1. Satisfaction index (good and very good), surveys 1995-2000, to employers (1- technical knowledge adequacy; 2- integration ability; 3- responsibility; 4- multi-focus capacity; 5-dialogue capacity).

Although the course therefore seems to have revealed a satisfactory degree of efficacy, the question of its efficiency remained to be addressed.

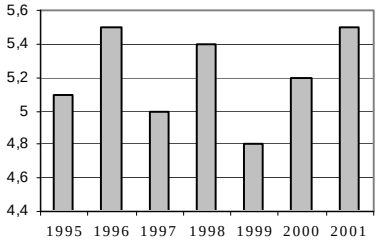

Figure 2. Years of study per pass degree.

Those students that graduated spent far too much time, under our point of view, in the completion of their studies (Figure 2), though these are figures even a little under the average national value for technological areas in higher education systems, and quite between gross values considering the whole of the European Union (average over the referred 7 years, 5.2).

3. Former Measures

Several initiatives have been carried out, especially during the last four years, such as the analysis of the official curricula of the state high school system and assessing the actual content covered in high school, in order to prepare revision tutorial and lab classes. Also psychologists from the outside of school were contracted to deliver seminars/workshops on study methods and the number of students per class was diminished.

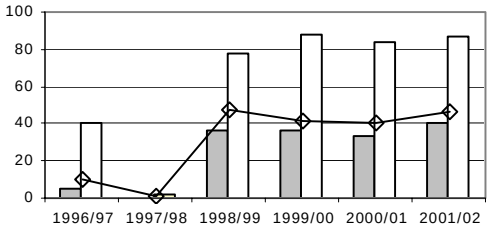

Figure 3. Freshmen dropout rates (%), line, overall dropout number of freshmen, filled columns, total number of incoming students, blank columns.

A more concise evaluation was made by means of different surveys regarding former freshmen motivation when choosing mechanical engineering and industrial management, and the main threats felt when entering the course. Regarding the first issue, the answers indicated an easy access to employment and a sense of identification, generically focused on cars and machinery. As to the second one, the main worry detected was "not being able to cope with the subjects". This last issue was somehow consistent with the grades students presented at arrival. An effort to adapt educational practice to the difficulties of the existing students (Vigotsky, 1986; Resnick, 1989; Postic, 1995) was decided and a series of measures trying to work against these trends were taken and are in place since 1999.

4. New Approaches

4.1. Broad Initiatives

Classical separation between theoretical and tutorial classes was abandoned, thus aiming at breaking the frontier between theory and its application.

Record of attendance: Attending classes was considered of major importance and was to be enforced, as a way of making things easier for those students that were effectively committed to the course. All subjects adopted a uniform 75% minimum attendance and also were developed means of observe and assess participation. Non-compliance with these limits disqualified the student from tests and normal schedule exams.

Lab work within a mainframe distribution: Whenever possible, the first two weeks experiments should be realized by the teachers, followed by lab work installed and realized by students; synthesis experiences could be offered as options to be chosen or even created by students, and could be accomplished in 3 or 4 weeks at the end of the semester.

Pedagogical preparation plus team teaching: As more experienced teachers follow a pedagogical three year program finishing next year, new teachers were invited to either enabling pedagogical training attending workshops organized by older colleagues and/or to share classes with them, thus giving the opportunity to see experienced colleagues at work and allowing the more experienced to see and discuss new approaches during debriefings. These routines hopefully provide more regular discussion on course objectives, as well as on scope, approaches, philosophy and procedures for a given course.

4.2. A Freshmen Reception

A two weeks reception named “Starting Over” has been implemented for the last 5 years, starting with the very first act of registration at school, made by the teachers themselves, providing a warm first contact, helping with all the bureaucratic formalities and taking them on a guided tour of the department facilities. One other purpose is to avoid freshers’ involvement in the initiation rites prevalent in Portuguese higher education (which tend to create a conformist attitude towards institutional and student life itself). The first day of formal scholar activities began with a mix of activities developed in order to focus on the socio-pedagogical aspect on the one hand and the ludic and sporting aspect on the other (Silva and Sá, 1997).

The first, the socio-pedagogical aspect, concerned sociology workshops, cooperation oriented and specifically introducing situations where cooperative learning was advantageous, study methods, intended to enhance structured note taking, time management and organized data research, interactive science expositions, an astronomy conference and nocturnal astronomy-observations, and visits to industrial enterprises where former mechanical engineering students were working, ranging from small-scale plants to a Citröen car plant.

The second, the ludic and sporting aspect, was focused upon to show that student life has more things to praise than just science and study. It was composed of a paper chase, a football game between freshers and teachers, a kart contest and two visits to characteristic sites with a cultural background: a spa from the roman era and a sightseeing tour to the mountains and World War II wolfram mines.

The penultimate day was devoted to an introduction to the course, given by the subject heads that introduced their colleagues and outlined the subjects to be studied. The session was closed with a lecture, focusing on technical skill and the capacity for team work, which was given by a well known company manager.

Figure 4. Introduction to the course given by subject heads.

The last day was used for an award ceremony to the best students as well as participation tags to freshmen made by sophomores. It ended with the projection of a movie where the mechanical engineering course areas were underlined and alumni were interviewed.

The survey’s analysis of this reception period undoubtedly showed that it created tight links between freshers, teachers and school, favored integration and increased collaboration among students.

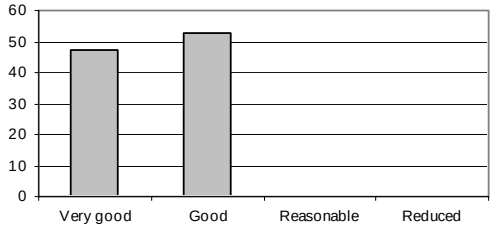

Figure 5. "Starting Over" satisfaction index (%).

All these initiatives revealed to be insufficient in a sense that they were not addressing the issues that could, under our recognized limitations, cause a somewhat significant change of the established trend. The dropout rates were still high and the efficacy stayed at a low level. This led to the decision to implement an new socio-pedagogical project called GOIS (from Damião de Góis, a prominent Portuguese and European renaissant, born in 1502 in Alenquer, contemporary of Erasmus and Luther, with whom he not only exchanged a rich epistolary correspondence but also was their guest in the period when he was the representative of the Portuguese crown in the mighty Antwerp trading station, facts which were the source of troubles and eventually of his death in 1574; he stands as an exponent of the Portuguese opening to the world), to stress the need for a wider view of the constraints, an assumed opening to the schools external context, as a way to seek progression on understanding.

4.3. Focusing specific goals: a three-fold project

Teachers involved in this work are no specialists of any kind. An assumed discrete approach was chosen, though recognizing that the issues addressed are probably far more complex than our background enables us to identify. Our institution has still no professional services of psychological counseling, so this, somehow, could excuse gross errors to be perpetrated.

It was decided to start with personal and structured interviews, performed to collect data in order to select a group of fifteen students to start, during 2002/03, GOIS first edition. The interviews involved forty-nine Mechanical Engineering and Industrial Management course freshmen.

The analyzed variables, which constituted the basis of the selection criteria (Fachada, 2001), can be grouped in three main categories: (1) socio-demographic, (2) academic and (3) motivational.

1. The socio-demographic variables referred to students' characterization by gender, profession and residence. Due to the existence, in the course, of a large majority of male students, it was found to be interesting, as a mean of forcing diversification, to select some female students. Working-students difficulties were also considered, as well as the specificity of those that had the permanent residence more than 20 km from school, as this could interfere with the available time. These cases were taken as specific groups to monitor.

2. Academic variables consider the incoming options, as those that had influence in choosing the course, high school grades and subjects preference. Course options in the incoming process should be related with motivation; however some students conduct their decisions to guarantee a place. High school grades and subjects preference were thought to be important to understand the orientation needs of this project.

3. The last category is related not only with first impressions *versus* initial expectations but also with the participation in "Starting Over". During the interviews GOIS main goals were explained; as a result the observed reactions were taken into account, namely motivation, interest and available time of freshmen if they were to be chosen.

The final selection was reached through the analysis of students' academic curricula, in order to evaluate their performances in precedent high school. The goal was to certify that a heterogeneous work group was formed. From this context we can observe different behaviors in tertiary education, resulting of the levels of preparation and satisfaction, having influence in decisions related with academic future as it has a strong influence on the development of some important skills.

In brief, the goal pursued was actually a modest one- helping freshmen to deal with the important challenges they had to face when stepping into the brave new world of higher education.

The program was a two-semester lasting period project. It was developed thorough one-hour week sessions with the participation of the fifteen selected freshmen (twelve male and three female) and three teachers. At the end of each semester a set of interviews was made to evaluate the work done. Beyond their opinions, during these interviews students could also suggest new subjects and possible changes in future interventions. Although the students haven't suggested different subjects or changes, GOIS was foreseen to be a flexible project in order to adapt to and encompass with momentary needs and students desires.

The main issues to be presented and discussed along the project can be divided into three areas: study techniques, relationship management and reading/comprehension.

In a first moment, in order to perform integration as a group, both students and teachers, the development of affective links were enabled by means of individual presentations following *in situ* interviews. Later on, these aspects

were strengthened using the opportunities that arose from the comments that each and all of the participants made about the results of self filled questionnaires from Briggs-Meyer personality type tests.

Next, and following a previous structured road map, study techniques were approached, starting with time management and with the discussion around the importance of being efficient and assuming proactive attitudes, either in class or during study and research.

5. Results

Data handling was made profiting of the work done by some colleagues, involved in sociological MSc that were studying the same academic community, during identical periods of time (Mateos *et al.*, 2002). From a general and broad point of view, students were very keen of all the activities that were developed having their situation in mind. From the very beginning, meeting theirs pairs at weekends, they were able to compare their situation with what was reported from other places, weather other universities or polytechnics (more than 40 % are coming from other regions) and, if only those impressions were to retain, they seem to have felt very comfortable with it and with a clear impression that they were a major component of the school and department's activities. Further on they have also realized that the complementary concern, the other major component, was knowledge (Kelly, 1991). As far as GOIS is concerned, students considered it of the outmost importance, especially socio-pedagogical activities and they would like to experience a more extensive approach to study techniques issues.

Students revealed a change in attitude towards studying and recognized the validity of GOIS which was assumed as very useful. In that sense, students showed sufficient motivation to continue to participate in those sessions along the forthcoming second semester.

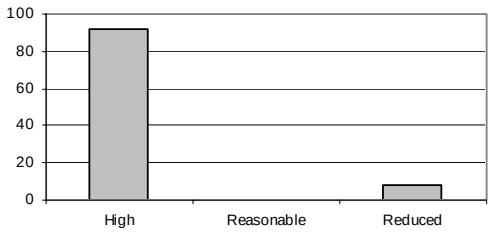

Figure 6. Motivation index (%) for the continuity of participation in GOIS.

Beyond the favorable opinion with the participation and results with GOIS, the students also revealed a high satisfaction index with the Mechanical Engineering Course, even those that had not chosen it as a first option.

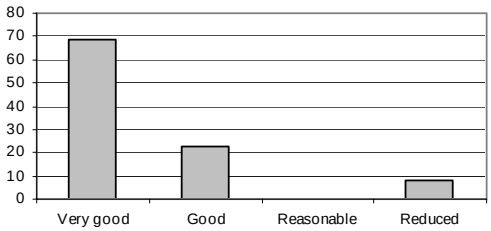

Figure 7. Mechanical Engineering Course satisfaction index (%).

The importance of the activity aims developed in the initial phase of the GOIS project, namely the personal knowledge and group integration, was not an immediate recognition by the students.

Table 2 – Number of first attempt passed grades by students having attended to GOIS.

Nr of students	First attempt passed grades
1	6
2	4
3	3
3	2
3	0

In their own words, "At the beginning, it didn't seem of any use, but, after talking to colleagues that remained up to the end, I concluded that yes, the project was worth hardly.", "It's a good initiative, those that didn't continue didn't

even gave it a try" or "I don't know how I would have managed if I wasn't attending the project, but I feel that it helped me foreseeing difficulties and managing time.".

Though still quite insufficient, the effect on the number of passing grades will certainly be, if consistent, a serious factor for attracting new students to this sort of initiative, as well as increasing freshers retention.

6. Conclusions

There are no significant results, at this time, as the students are still to end their academic activities. The importance of this initiative will be better assessed at the end of the year, especially in what concerns the rate of retention (weather it increased or not, either from this particular group, either from the whole of the freshers). At this moment, nonetheless, and based on the results of the enquires, there seems to have been a better integration, on the one hand, and a better rationale to internalize those key issues that effectively conditions the success of first year incoming students, on the other. Should there be no more positive outcomes, this would be a sufficient reason to repeat this initiative for the years to come, while this kind of particular context subsists in Portugal.

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