The Multidisciplinarity on The Development of Engineering Teaching

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ABSTRACT: *The fast growing world we live has as the main key the velocity of information transmission. Actually and globally, it is convenient for the engineering teaching to be intimately connected to this new context, and to the students to be prepared to act in a dynamic and multidisciplinary way. Based in those ideas, it was placed a new subject in the first years of engineering at Universidade São Judas Tadeu (USJT), located in São Paulo, Brazil, named Engineering Introduction, which has exactly the purpose of supplying students the first concepts of an integrated and multidisciplinary work, starting in the first year of their academic lives. This subject has already been discussed in others Brazilian conferences about engineering teaching, but in this work, we present a particular activity, inserted in this subject, which has been conquering very satisfactory results. This activity aims to join some topics as: the research, the planning, the construction and a presentation of an artifact to fulfill a certain mission. At the end, this practice will culminate in a competition among the groups of students, with a view to motivate the first thoughts of multidisciplinarity. Another mission is to improve the level of the Final Course Paper (FCP), which must be presented in the last year of the engineering under graduation course.*

1. INTRODUCTION

Actually and globally, it is widely recommended that the teaching process should be oriented in some dynamic actions, strongly related to the dynamic world we live, since the increasing evolution of this world has the information transmission as the main key. (Shiga, 1999).

The amounts of information of any subject available today are very numerous, mainly when it comes to consider the Internet searches easiness.

Therefore, the research work became some kind of different from the ones, performed some years before, when the work was based mainly on the difficult search for subjects in periodic, books, newspapers and specialized magazines, available in the libraries. Nowadays, apart from these tools, the research work also includes the ability to filter through the Internet, to access good information in order to include them into your research.

In the engineering teaching, we often observe, and it is very important to mention, that researches and works based mainly in calculus or pure concepts of mathematics and physics, are not attracting the students anymore, mainly the beginners of the course, who seeks immediately for something more concrete and visible. These concepts are not less important nowadays, in the other hand, the basic concepts taught in engineering course were, are, and will be always important and must be well learnt, so as to become the base of the learning in this area.

The nowadays engineer is formed by widely concepts, and the practical situations which the new engineers are submitted, show that the always-growing technology requires something different, that may come to complement the technical concepts learnt on the schools.

Based on these arguments, the fresh engineers in the market, must have not only good and well established technical concepts of their graduated area, but also multidisciplinary and a global wide vision of their work besides the world they live. This profile became essential for the actual engineers, and according to the idea presented in this paper, it must be built since their basic formation, or rather, since they enter university.

The challenge to improve these characteristics has been studied in several papers presented in many conferences about the engineering teaching (Cytrynowicz, 1991).

The school curriculum cannot be limited to a simple list of contexts, but to a collection of processes that take into account the critical approach of acting, thinking and feeling, to develop new kinds of procedures (Arbache et al. 1997).

Therefore, it became necessary to re-think of the engineering teaching paradigm, analyzing it under a global optics, considering the whole, instead of treating the engineering as single box of isolated subjects (Pereira et al. 1997).

Together with this modernity in the engineering teaching, we can find a world where the global information owning created the well know information society (Delyra, 1997).

Since 2000, it was placed a new subject in the first year of engineering course of USJT, named Engineering Introduction. The main characteristic is to provide multidisciplinary activities related to the function of collaborating with the development of the modern engineer profile, here proposed, since the beginning of the course, which is the main purpose of this work.

2 METODOLOGY

2.1 The project

The multidisciplinary activity placed in the first years of the engineering course, which was described in the beginning of this paper, consist in the construction of an artifact to fulfill a certain mission, designed by the professors board, responsible for the subject. It is important to mention that this activity gives the fresh students also the possibility to integrate with each other, as well as the objectives already mentioned.

The analyses of the artifacts developed by the groups of students, show several important characteristics, developed and used in the project, as:

- Theoretical concepts;
- Multidisciplinary concepts;
- Planning of the work schedule;
- Research work;
- Planning of the project;
- Confection of cost project;
- Team work;
- Confection of physical artifact;
- Elaboration of the written part;
- Quality of the bibliography;
- Examining board presentation and publishing of the artifacts.

The presentation is made in a connected way, to guarantee that the public presentation happens together with the examining board presentation, constituted by the project-oriented professors, Engineering Introduction professors, and also invited persons, who can be as well as interested professors and area professionals.

This activity, in the final stage, is performed in a festive way in the university sports gymnasium, with the support of friends and even family. It should be drawn that, besides achieving the proposal objectives, the presentation intends to cheer together all the students and community in an intelligent and pleasure way.

In the end of the event, all the participants, apart from their grades, receive a participation certificate. However, the best works are presented in others events, like the Engineering Week, and the intern symposiums of the school. They are awarded also, the opportunity to show up their work in the university newspaper.

However, it is important to clarify that the biggest award received by all students, is to realize that, since the beginning of their engineering course, all the knowledge learnt are useful, and it can and should

be put in practice. The team-work and the multidisciplinary way is the key for a complete and different academic formation.

Another important point is related to the costs. The university do not accounts absolutely any cost. The students group should assume it. A cost optimization, so important part of the actual engineers job nowadays, are sooner implemented in the students mind, since the beginning of their academic lives. For this reason, they are motivated to use recyclable materials for the confection of the prototypes.

2.2 The themes

In the first year where this activity was implemented, in 2000, it was proposed a confection of a mini-car, Dragster type, with a view of going through a certain distance in the most rectilinear way as possible, and stopping with the highest precision, in a certain tag, in the end of the course.

The prototype should be developed in such a way to obey a model, in a shorten scale, a real vehicle, and its construction should be made of, mainly, with recyclable material, as the final cost would be a grade evaluation item.

Figure 1: 2000 event – Dragster mini-cars: the race

It is possible to notice that this activity included, clearly, physics concepts, calculus, technical draws, environmental science, and mainly, a high dose of good sense, creativity, eager, imagination and team-work.

We need also to highlight that, as we are dealing with first year students, the safety must be considered. That is why, for speeding the cars, it was forbidden the use of organic fuels or explosive materials.

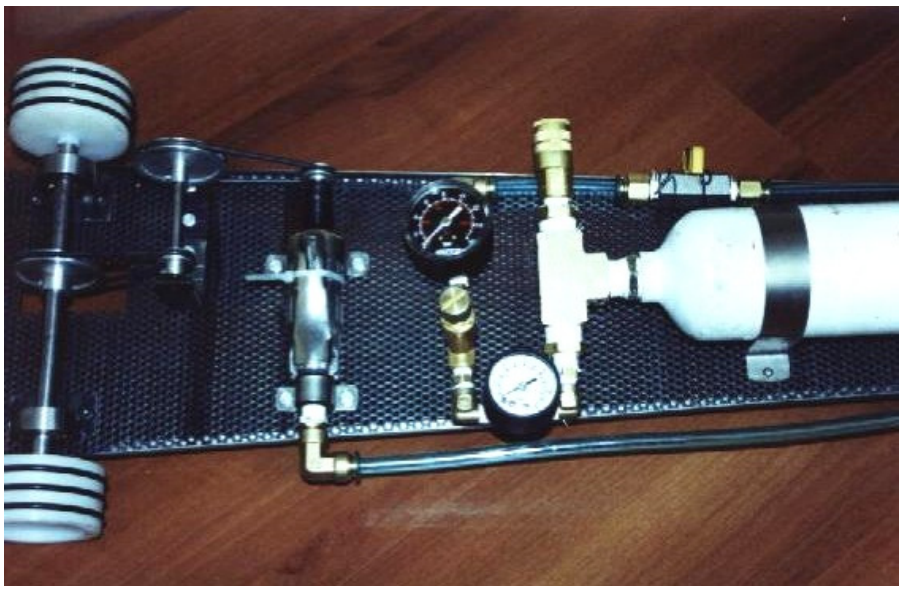

Figura 2: 2000 event – Dragster mini-cars: some details of a car

In similar ways, in the next years, others themes were proposed, so that all the objectives and characteristics are sustained.

In 2001, the objective was the development of a device that should throw tennis balls in a fixed target, but the distance, under a considered margin, should just be declared in the presentation day. It was named: The ball thrower.

Figure 3: 2001 event – Ball thrower

In the next year, the proposal activity was to develop a track, or a course, where some billiards ball should run a certain way, and through it, perform some specific jobs. This work was nominated: The route.

Figure 4: 2002 event – The route

Last year, the proposal was some kind of opened-free, and was consisted in the development of a toy, that should present knowledge of at least two science areas. This theme, called, Toy, resulted in some very original prototypes.

Figure 5: 2003 event – Toy

2.3 The written part

The written part is made up of an executive project, which has:

- The main purpose of the project
- Working schedule
- Material list

- Theoretical basement
- Draws
- Calculation table
- Components details
- Development details
- Photos
- Costs table
- Test report
- Prototype conclusion
- Individual conclusion of each student
- Future improvements
- Bibliography

The chosen methodology for the development of the written part follows exactly the same model that will be asked in the written part of the FCPs that the students should elaborate in the last graduation year. The main purpose is to give students, since the beginning of their academic lives, the knowledge of a certain procedure which will be very helpful in the development of others works through their course, and mainly in the end of it.

3 THE CONECTION WITH THE FCP

It is expected in the presentation of the FCPs, performed in the last year of the course, that it will be possible to notice if there is an improvement or not in the works, due to the process here described, and implemented in these years.

The FCPs has as main goal to propose graduation students to elaborate a work based in a wide, original and multidisciplinary study, about a certain subject of interest. This work must be conquered since the decision step of the themes, going through a whole development process till its end, which will culminate in the writing of a monograph, an article, a chart and the presentation for an examining board.

This process named FCPs, including all the development, following and evaluation, has already been studied in others papers (Pegollo e Shiga, 2001).

Once applied to the activities here described, it is expected that, in the last year of their engineering course, the students have greater performance, dynamism, and multidisciplinary capacity to reach good decisions and act in some specific task, with a global view, instead of a single specific view.

The first graduation class that participated in the proposal activities in the discipline Engineering Introduction, will graduate in 2005. Only after this date we could gather the first data against the acknowledge of the ideas here presented.

These results will be presented and discussed in another opportunity.

4 FINAL CONSIDERATIONS

Since 2000, first year that the activity here described was applied, we could notice that fresh students were widely motivated, and we also observe that professors of correlated disciplines, involved in the activities, could also fell an increment of the interest of the students in their disciplines.

However, we still do not have an effective results table. We wish to elaborate it as fast as the 2000 graduation class finishes their course. In this moment, we will develop this table, task not so easy, which we are counting on the help of specialists professors of this university, to gather relevant and comparable data regarding this class and the previous ones, related to any kind of factors we urge to be necessary. These data, once gathered and studied, will be presented and discussed in another opportunity.

5 THANKS

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