AN ENGINEERING COURSE EVALUATION: MEASURING THE STUDENT'S SATISFACTION LEVEL

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Abstract. *This paper presents the results of a research to check the satisfaction level of the under-graduate students of a public institution' enginnering course. The methodology used to establish the Quality Index was based on paper "Public University Service Quality: a perceptive evaluation" with adaptations. A questionnaire was applied comprising a variety of aspects - indicators - grouped in three dimensions: didactic-pedagogical organization; faculty; and installations. Based on frequency obtained with data tabulation was associated a satisfaction index for each indicator. This evaluation instrument has been applied since 2004 to production engineering students of CEFET/RJ and can be used to any engineering course.*

Keywords: *Engineering education, Evaluation system, Satisfaction Index*

1. Introduction

In the last years, the Education Ministry (MEC) of Brazil comes adopting evaluation mechanisms to survey the quality of the graduation courses from the superior education institutions. The objective of these evaluations is to have a data base allowing to create a proper politic destined to the quality improvement of the courses and institutions in order to correspond the expectations from the government, the academy and the society with the purpose of guarantee superior education growth with quality.

The Brazilian System of Evaluation today is formed by *Institutional Evaluation*, by *Educational Conditions Evaluation* and by *National Exam of Course*. The evaluation processes are added to the systematic and annual collections of data on the Superior Education Institutions and its courses: Superior Education Cadastre and Superior Education Census (Pacheco, 2005).

This context becomes necessary the creation of self-evaluation instruments to their graduation courses in order to diagnose the critical points which need to be improved.

The article's objective is to present the application results of an engineering course auto-evaluation instrument to verify the students' Index of Satisfaction regarding to some aspects.

The used methodology to reach the called Index of Quality Perceived at Service was based on the work "Service Quality of a Public University: a perceptive evaluation" suffering some adaptations.

A questionnaire was applied enclosing some aspects – indicator – grouped in three dimensions: didactic-pedagogical organization; faculty; and installations. Through the frequency gotten in the data tabulation, an index of satisfaction is associated with each indicator. The most closer to 1,0, higher is the students' satisfaction level in concern to the evaluated aspect. An index below 0,5 demonstrates a low pupils satisfaction level.

This evaluation instrument started to be applied in 2004 between the students which were finishing the senior year of the Production Engineering course in CEFET/RJ. It can also be applied to any engineering course.

2. The National Superior Education Evaluation Sistem

According to article 9th., item IX, of the Law of Guidelines and Bases of the National Education - LDB (Law n°. 9394/96), are attributions of the Union: "to authorize, to recognize, to accredit, to supervise and to evaluate the courses of the institutions of superior education and the establishments of the Federal System of Superior Education." With legal base in LDB, the National System of Evaluation of the Superior Education (Sinaes) was created through the Law n°. 10.861 of April 14, 2004, becoming the new instrument of evaluation of the superior education of MEC.

The information obtained with Sinaes should be used by Superior Education Institutions, for orientation of its institutional effectiveness and academic and social effectiveness; for the government organs to guide public politics; and for the students, students' parents, academic institutions and public in general, to guide their decisions as for the reality of the courses and of the institutions (Pacheco, 2005). It is also starting from the results of those evaluations that

regulators procedures will be considered as accreditation and renewal accreditation of the Institutions of Superior Education and authorization, recognition and renewal of recognition of graduate courses.

Sinaes is formed by three main components that are:

1. Institution Evaluation: constituted by the institutional self-evaluation, accomplished in a permanent way and with results presented every three years under responsibility of the Own Commission of Evaluation nominated for each Superior Education Institution, and by the external institutional evaluation, accomplished *in loco* by a commission of appraisers of National Institute of Educational Studies and Researches (INEP).
2. Educational Conditions Evaluation: realized by a commission of appraisers of INEP to check *in loco* the conditions and functioning of the courses.
3. National Exam of Course: it consists in an examination for the students that are beginning and that are in the end of the course to check their performance.

In the Educational Conditions Evaluation, the verification *in loco* follows the called Course Evaluation Manual that contains all of the information considered pertinent and that are organized in three dimensions: didactic-pedagogic organization; faculty; and installations. These dimensions are subdivided in analysis categories, indicators and aspects to be appraised as shown in Figure 1 (INEP. 2002). Each aspect receives a concept of the appraisers that in some cases can be very weak or very good; in others it can be very weak, regular or very good; and in other cases it can be very weak, weak, regular, good or very good.

Dimension	**Category**	**Indicators**
Didactic-pedagogical organization	Academic administration	Coordination of the course; academic-administrative organization; attention to the students
	Project of the course	Conception of the course; curriculum; evaluation system
	Articulate academic activities to the graduation teaching	Students participation in academic activities; supervised probationary period; final project course
Faculty	Academic and professional formation]	Formation; professional experience; appropriate formation
	Work conditions	Work regime; career plan; professional incentives; dedication to the course; students/teachers relation; matters/teachers relation
	Academic and professional performance	Publications; intellectual, techniques, pedagogic, artistic and cultural productions; activities related to the graduation teaching; performance in the academic activities
Installations	General facilities	Physical space; equipments; services
	Library	Physical space; collection; services
	Facilities and specific laboratories	Support laboratories to the teaching of basic contents; of general contents; and of specific contents

Figure 1. Dimensions, categories and indicators of courses evaluation

In didactic-pedagogical organization dimension – course project category – can be observed the indicator evaluation system. This indicator means that all courses must have a self-evaluation project. The non existence of a self-evaluation system will result in a very weak concept.

Also Resolution CNE/CSE 11 of March 11, 2002 that institutes the National Curriculum Guidelines of Engineering Course Degree establishes in Art. 5th. that “each course of Engineering should possess a pedagogic project that clearly demonstrates as the group of foreseen activities will guarantee the wanted profile of its exit and the development of the competences and expected abilities.”

In this context a self-evaluation system is an important factor to improve the quality of engineering courses in Brazil. The literature about Quality presents the PDCA Circle (Figure 2).

In this circle, P means Plan; D means Do; C means Check; and A means Act (Deming, 1990). In others words, to improve the quality it’s necessary to have objectives, implement actions, and always to check the results to know what it’s necessary to correct and to perfect.

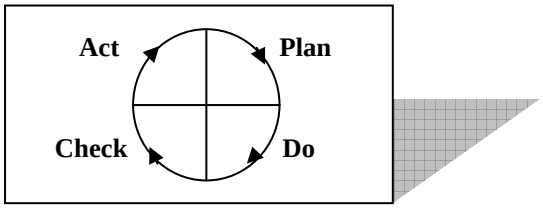

Figure 2. PDCA Circle

3. Metodology: the Quality Index

The methodology used to evaluate the course was based on the paper "Quality Service in a Public University: an perceptive evaluation" by Cristina Faria Fidelis Gonçalves (2003). As the proper title suggests, it is about a qualitative evaluation that consists on an opinion research among the students to identify the satisfaction level with regard to a set of considered aspects.

The methodology consists on applying a closed questionnaire where the students - for each related item - attribute a concept that can be: Very Good; Good; Regular; Weak; Very Weak.

First of all, the data are tabulated by calculating the relative frequency (in decimal values) of each concept taking in concern to each evaluated item. After that, the relative frequencies of the concepts good and very good are totalized as one single frequency. This will be the referring quality index for that indicator. Table 1 presents an example referring to the supervised probationary period indicator evaluation (Gonçalves, 1998).

Table 1. Example of supervised probationary period indicator evaluation

Evaluation	F	%
Very good	4	18,18
Good	11	50,00
Regular	5	22,73
Weak	2	9,09
Very weak	0	0,0
Total	22	100

By Tab. 1, the Quality Index of supervised probationary period indicator is the result of the sum between the relative frequencies: 0,18 (very good) with 0,50 (good), that results in 0,68. This way, the Quality Index for a certain indicator can vary between zero and one. The closest to one, higher is the Index of Quality what means a better quality perception for that indicator. Quality Indexes below 0,5 indicate low satisfaction, what identifies which aspects need to be improved.

To discover the Quality Index of a specific dimension, it is just about calculate the arithmetic average that consists on the sum of the relative frequencies for each indicator which composes that dimension divided by the number of indicators. Figure 3 presents an example of faculty dimension Quality Index.

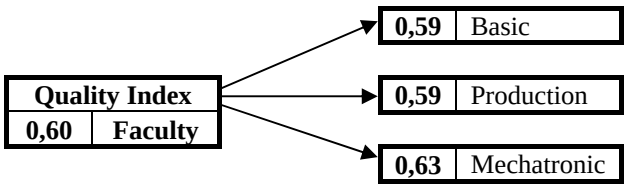

Figure 3. Faculty Quality Index example

Although the calculation of the index has followed the methodology indeed proposed by the author above, the appraised dimensions as well as the indicators were adapted for best to adapt to the needs of self-evaluation of the production engineering course of CEFET/RJ.

The research instrument - in the case, the questionnaire - it was structured from way to contain three dimensions: didactic-pedagogic organization; faculty; and installations, as the constant dimensions in the Course Evaluation Manual Manual defined by MEC/INEP.

As some indicators would not be susceptible to evaluation on the part of the students were just selected the most appropriate for that evaluation type. Figure 4 appraised the indicators grouped in didactic-pedagogical organization used in the questionnaire.

Dimension	Indicators			Very good	Good	Regular	Weak	Very weak
Didactic-pedagogical organization	Coordination of the course							
	Course project	Conception of the course (mechatronic)						
		Curriculum measurements						
		Curriculum organization						
		Matters offered	Basic					
			Production					
			Mechatronic					
		Contends of matters	Basic					
			Production					
			Mechatronic					
		Time of matters	Basic					
			Production					
			Mechatronic					
		Supervised probationary period						
		Final project course						

Figure 4. Indicators of didactic-pedagogical dimension

Figure 5 shows the questionnaire model to evaluate the faculty dimension that was divided in three groups: basic contends teachers; production contends teachers; and mechatronic contends teachers.

Dimension	Indicators		Very good	Good	Regular	Weak	Very weak
Faculty	Basic	Subject knowledge					
		Teachers' didactical					
		Evaluation criterion					
		Student' relationship					
		Frequency and punctuality					
		Fulfillment of program					
	Production	Subject knowledge					
		Teachers' didactical					
		Evaluation criterion					
		Student' relationship					
		Frequency and punctuality					
		Fulfillment of program					
	Mechatronic	Subject knowledge					
		Teachers' didactical					
		Evaluation criterion					
		Student' relationship					
		Frequency and punctuality					
		Fulfillment of program					

Figure 5. Indicators of faculty dimension

Finally the Fig. 6 contends the indicators that complete the installations dimension. These indicators were organized in four groups: material resources; secretary' office; library; and campus.

Dimension	Indicators			Very good	Good	Regular	Weak	Very weak
Installations	Material resources	Classrooms	Physical space					
			Access					
		Laboratories						
		Auditoriums						
		Computers and Internet						
	Secretary's office	Academic system						
		Service to the students						
		Schedule of operation						
	Library	Collection						
		Service to the students						
		Schedule of operation						
		Physical space	Individual study					
			Group study					
	Campus	Location						
		Physical space						
		Maintenance						
		Sanitary facilities						
		Mobility						
		Photocopy service						
		Snack bar – restaurant						
		Stationery						

Figure 6. Indicators of installations

4. Evaluation results

The questionnaires were applied to the students were doing Final Project of Production Engineering course of CEFET/RJ in the second period of 2004. The reason of choice by these students is that they could answer about a global perception of course. In the total were answered 22 questionnaires (56,4%) among 39 students that accomplished the final project defense. It wasn't obligatory to answer the questionnaire and the students didn't need to identify. The results obtained with the tabulation of the answers are in Figs. 5, 6 and 7.

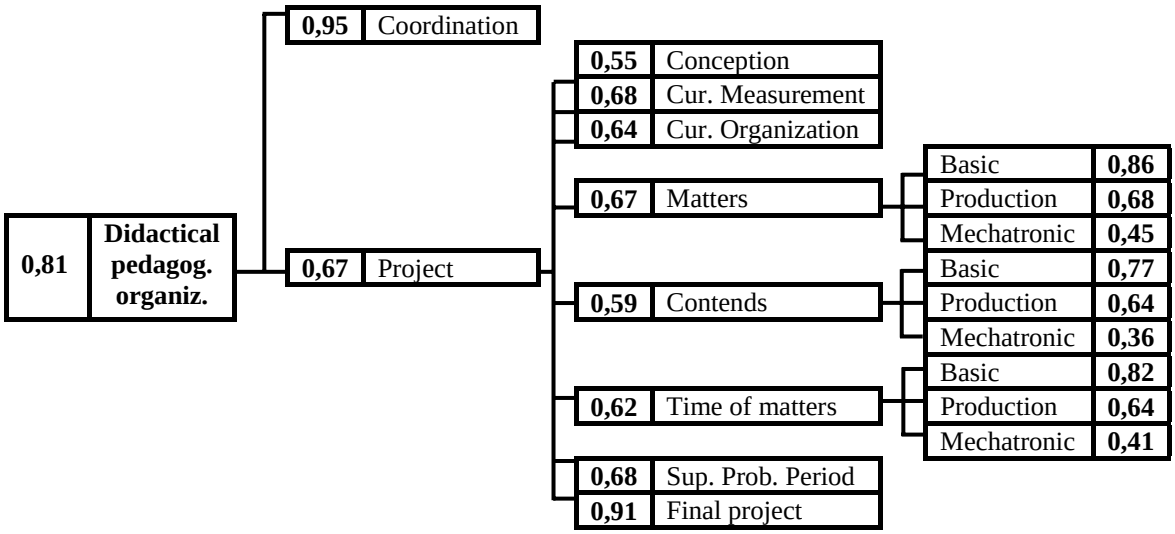

Figure 7. Didactic-pedagogical organization Quality Index

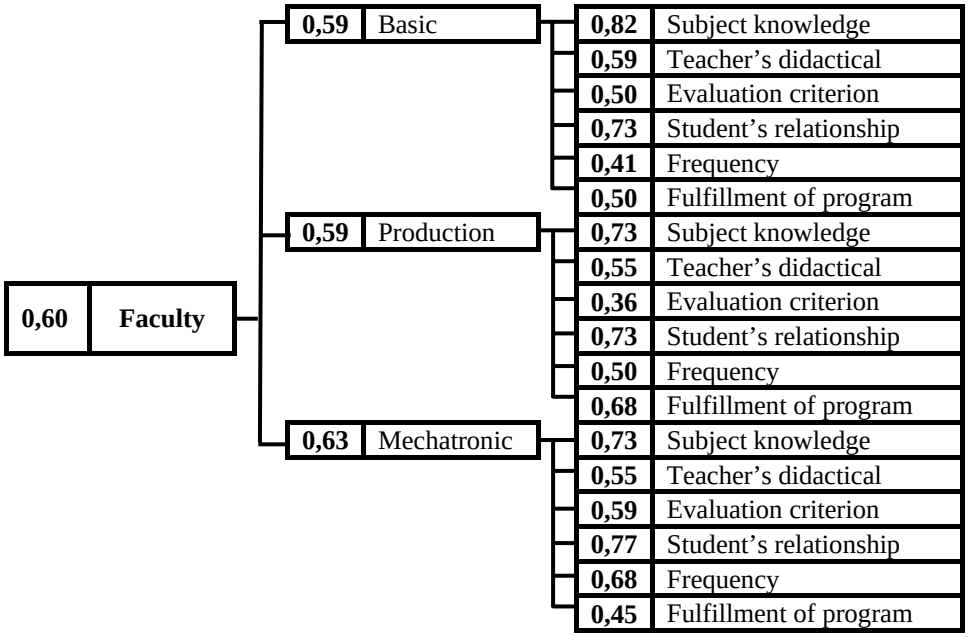

Figure 6. Faculty Quality Index

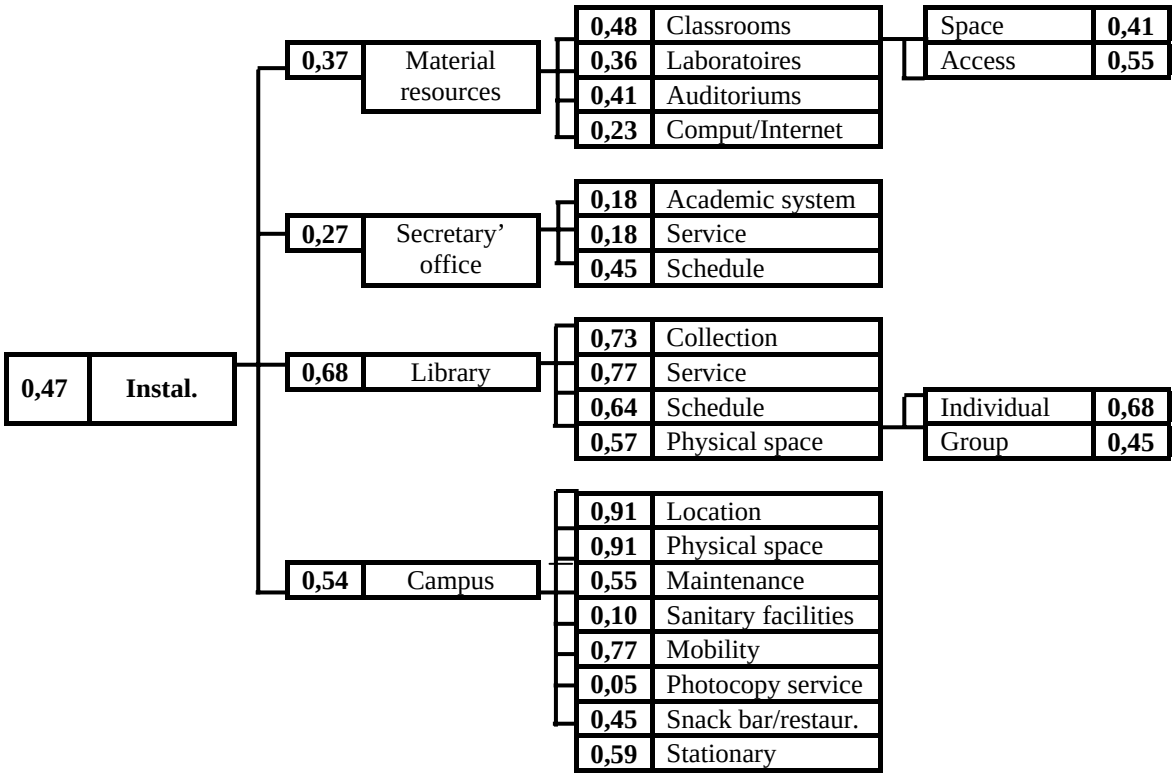

Figure 8. Installations Quality Index

5. Results analysis

Among the three appraised dimensions the one that presented better Index of Quality was the didactic-pedagogic organization of the course, following by the faculty and the installations.

Regarding the didactical-pedagogical organization dimension, the best pointed indicator was the academic coordination with index 0,95, therefore, near of 1,0. Soon afterwards, the final project organization came with index 0,91. The offer of matters, contends of matters and time planned for the matters also had satisfactory indexes: 0,67; 0,59; and 0,62. However, when analyzing the matters according to the group (basic matters, production matters and

mechatronic matters), it's observed that basic group presents larger satisfaction index, following by the production group, both with positive evaluation in all of the appraised items, in other words, with index above 0,5. Already the mechatronic group presented unsatisfactory evaluation in these three aspects. The result demonstrates the need of to improve changes in mechatronic matters. Probably this situation can be reflecting in the conception course evaluation with index 0,55.

For faculty dimension, the indicators were satisfactory. There wasn't great difference in the satisfaction index regarding the teachers of the three groups – basic (0,59), production (0,59) and mechatronic (0,63). It's important to say that CEFET/RJ couldn't to contract permanent teaching staff because there weren't public concourses for a period of time. As Production Engineering is a new course in the institution – it began in 1998 – the students that answered the questionnaires had classes with many provisional teachers. Now the situation is changed. With the authorization and accomplishment of new concourses and the structuring of an effective teaching staff, probably there will be the improvement of that dimension in the next evaluations.

Infrastructure was the dimension that obtained the worst evaluation. Although the library and the campus have had positive evaluations, the general index of the quality noticed by the students as for that dimension it was unsatisfactory because of the negative evaluations of the general office and of the material resources. However, it is important to mention that in what refers the infrastructure several improvements were accomplished in the last year, what also will probably be reflected in the next evaluations. Among the verified improvements can be mentioned the construction of new classrooms, reforms in old classrooms and in the sanitary facilities of the institution, the creation of laboratories mainly for the specific contends of the course, and the investment in the purchase of computer science equipments. Also the general office is suffering a restructuring with the implantation of a new academic system.

6. Conclusion

The implantation of a self-evaluation process is fundamental to look for the improvement of the courses' quality. It becomes an important instrument to detect problems and to guide the decision make. In the case of the evaluation of degree courses it is treated of an useful process to aid the coordinators of the courses and the managers of the superior education institutions to prioritize actions and investments.

The knowledge of the Index of Quality noticed by the students already supplied subsidies for certain decision make for the improvement of the course. An example was the pointed index as unsatisfactory regarding of mechatronic matters group. Based on this result, other opinion researches were accomplished involving students of all the periods of the course. These results are being considered in the change of the curriculum that is happening in the reform curricular process of the institution.

There is intention to extend the self-evaluation process increasing other indicators in the questionnaire, implanting other evaluation mechanisms as an individual evaluation of teachers and matters, and creating a database that allows a better control along the time.

7. Acknowledgements

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8. References

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9. Responsibility notice