The use of qualitative indicators to evaluate professors from an Engineering course of a public university in São Paulo.

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***Abstract* - The main purpose of this work is to evaluate the quality of research and teaching of professors in the engineering area, analyzing the relationship between scientific indicators on productivity and the teaching process inside the classroom. A case study was made at Escola Politécnica (São Paulo - Brazil). The research question is: does the quality of research reflect on the capacity of professors as agents of the teaching-learning process? The sample studied considered over 90 professors and the following aspects were analyzed: academic degree, number of concluded PhD, MA and undergradute supervisions, as well as an analysis concerning the professors' scientific production since 2001. This data was compared with indicators of teaching quality from a self-administered survey answered by students in order to evaluate the courses taught by these professors. All data was processed using a descriptive statistics analysis. Concerning the scientific profile of professors, they are more alike, whereas the surveys' data contain a whole different aspect, where results are much more heterogeneous. This may indicate that teaching and research do not necessarily commit. Therefore further discussion on how to evaluate the professors' career in its totality would be necessary.**

Index Terms – Professor evaluation, Research indicators, Teaching evaluation.

INTRODUCTION

This paper aims to discuss about a docent evaluation that considers both research productivity indicators and teaching evaluation.

There is a need for an evaluation method that can qualify the professors in both categories, once there are teaching evaluations and ways of measuring the professor scientific productivity, but timid initiatives to evaluate both.

In the Brazilian Constitution of 1988, in article 207, it is said that public universities should obey the principle of indissociability between teaching researching and extension.

This model is still supported almost 20 years later, because, as the university is not only a service supplier, it should somehow give back to the society the investment once made in it.

RIBEIRO,[1] says that teaching is public, mainly because its results must spread throughout society, belonging to the sphere of the right which is potentially universal, and not treated as being a privilege which is limited

RIBEIRO,[1] also places the research in the noblest place at the academy.

MARTINS,[2] states that "(...) One way of evaluating this knowledge is by measuring the number of research papers.

MARTINS,[2] also says that: "surely no legislation has the capacity to implement a indissociation between teaching activities and research in all areas of a certain institution, let alone make a professor become a researcher or vice-versa."

In fact, facing the great development and institutional diversification of university teaching, Martins also reinforces that there is a "hierarchy of institutions" formed from indicators as "the quality of teaching offered, the heading of the teaching staff, the scientific capacity installed, the organizing formats of these establishments, the reputation and the social and symbolic recognition of the distinctive establishment they make."

But the discussion about docent evaluation concerning educational criteria is very recent, and its indicators have not yet been decided uniformly. Sometimes this discussion is still seen as a taboo, in contrast to the study of research quality.

According to LETA, CRUZ,[3] in the last decades of the 20th century, governments and researchers have organized studies to evaluate the scientific activities and technology in different levels of complexity. And one of the first studies done in this area was published by Coles and Eales (1917) and presented a statistical analysis of the compared history of anatomy.

Actually, one can notice that the research indicators are the most studied in order to evaluate universities, and specially professors.

The considerations above raise the following research issues:

1. Are the professors with scholarship the ones with greater productivity and number of concluded supervisions?

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2. Are the professors who produced more and have more supervisions concluded the ones with higher degrees?
3. Are the scientific productivity indicators related to the professor's teaching and didactic quality?

The objective of this research is to make a comparative study between teaching quality and the research productivity in an engineering course at a university in São Paulo-Brazil.

METHODOLOGY

The research took place at Escola Politécnica (Universidade de São Paulo, Brazil). It is a traditional institution in the engineering area, founded in 1893, which has 18 undergraduate courses today, 15 departments, 471 professors, 509 administrative employees and nearly 4700 undergraduate students and over 1700 graduate students.

The research data were collected from a total of 95 professors who teach at the school, most of them teaches the basic subjects common to the first years. So, in the sample, there are professors not only from Escola Politécnica, but also from the institutes that have participation in the formation of the engineering students, as the Institute of Physics, the Institute of Mathematics and the Institute of Chemistry.

The research was done in two parts:

The first, a documental research, obtained data from the *lattes curriculum*, a database of academic *curricula vitae* published on the Internet by the National Council for Scientific and Technological Development (CNPq), a foundation linked to the Ministry of Science and Technology. The following data were taken about each professor: gender, how long he/she has been in the career, his/her degree (master, doctor or above doctor), number of concluded supervisions (scientific initiation, undergraduate researches, master and doctorate), bonds to CNPq through the supporting program "productivity scholarship", which aims to distinguish the researcher by valuing his/her scientific production; and the number of scientific papers published according to the *Qualis* classification of journals, newspapers, magazines and conferences publications, a result of the rank made by Capes, a partition from the Ministry of Education that evaluates the national production on graduate level.

An observation must be made for the above doctor degree. In public universities, in the state of São Paulo the “free docent” *(livre docente*) is a level higher then doctor that only professors may achieve.

The *Qualis* criteria used from the Ministry of Education for publications is a way to evaluate the docents from a certain faculty or institute in order to grade the graduate courses.

The *Qualis* way to grade the quality of the professor’s research is using an indicator to the journal in which the paper was published.

This classification is divided into three journal circulation categories: International, National and Local, which are divided in three levels on decrescent order: A, B, and C. Resulting on nine categories according to *Qualis*. The papers considered in this study/analysis are the ones published since 2001 in order to measure recent productivity, not the entire professor's production.

The second part of the research analyzed the data collected from about 1500 undergraduate students from the first three graduation years, who answered a self-administered survey in 2006 at Escola Politécnica. The students answered with natural numbers to the following questions:

1. Give a grade from 0 to 10 to your professor's didactics.
2. Give a grade from 0 to 10 to your professor's commitment to the course.
3. Give a grade from 0 to 10 to your own commitment in relation to the subject.
4. What is the average of hours you dedicate to the subject (including works, reports, etc.)?
5. Do you think the test evaluated well the content taught in class? (Give a grade from 0 to 10).
6. Give a grade from 0 to 10 to the didactic material.
7. Independently from your performance in the test, do you think you are learning? Give a grade from 0 to 10.

The subjects that the professors from the sample teach are not always the same, as well as not all professors that teach a certain subject one year will be teaching the same subject the next year, therefore, this surveys diagnosis is only pertinent for the exact moment that they were applied. As well as they cannot be used in order to compare one year to another, since questions may vary from time to time.

SAMPLE PROFILE:

The sample of professors analyzed has the following profile:

I. Gender:

- 82% are male
- 18% are female

II. Degree:

- 60% are doctors
- 40% have a degree above doctorate
- there are no masters in the sample

III. Professional Career Time:

In Table I we can see that the professors' career time was divided into three segments/groups and that the sample has a homogeneous distribution between the segments/groups.

TABLE I
CAREER TIME

Career Time (years)	Frequency (% of Professors)
11 to 25 years	31.6
26 to 34 years	35.8
35 to 49 years	32.6

As for the participation in research activities, three indicators were obtained from the CNPq curriculum:
scholarship connected to the CNPq research promoting

program; number of supervisions in doctor, master and undergraduate level as well as scientific initiation; number of papers published in local, national and international journals since 2001.

IV. Productivity Scholarship connected to the research promoting program of CNPq:

- 34.7% have a productivity grant
- 65.3% do not have a grant.

V. Concluded Supervisions

In Table II we can see that almost 60% of the professors have not supervised any students in doctor level, while only 7.4% have more than three concluded supervisions. The same data for the concluded supervisions in master shows a smaller but still an expressive number, 35.8% have not supervised any master's student. Just a bit more than half is between one and six supervisions and only 9.6% supervised more than six master's students.

TABLE II
FREQUENCY OF CONCLUDED SUPERVISIONS IN POST-GRADUATE LEVEL

Number of supervisions	Frequency (% of Professors)	
	Doctorate	Master
No supervision	58.9	35.8
1 to 3	33.7	33.6
4 to 6	7.4	21.1
6 to 9	-	4..3
More than 9	-	5..3

As for the supervision of undergraduate students, Table III shows that 56.8% did not supervise any scientific initiation study, and more than three quarters of the sample did not supervise any undergraduate projects, usually known as course conclusion or graduation projects. We can also notice that only one eighth of the professors supervised more than six scientific initiation projects.

TABLE III
CONCLUDED SUPERVISIONS OF UNDERGRADUATE LEVEL

Number of supervisions	Frequency (% of Professors)	
	Scientific Initiation	Undergraduate
No supervision	56.8	78.9
1 to 3	14.8	11.6
4 to 6	15.9	6.4
7 to 9	7.4	-
More than 9	5.1	3.3

VI. Scientific Productivity

In Table IV we see that professors direct their effort towards publishing papers in international journals, level A.

While only 29.5% of the sample have never published papers in level A international journals since 2001, the number of professors who have not published in international journals levels B and C more than doubles, 74.7% and 85.3% respectively.

Among professors who have published papers in international journals level A, nearly half of them have published up to five papers since 2001.

TABLE IV
FREQUENCY OF NUMBER OF INTERNATIONAL CIRCULATION PAPERS

Number of papers	Frequency (% of Professors)		
	Level A	Level B	Level C
0	29.5	74.7	85.3
1 to 5	34.8	23.1	13.6
6 to 10	16.8	2.2	-
10 to 15	5.4	-	1.1
More than 15	13.5	-	

As for the national papers, only 16.8% of the sample have published up to four papers in level A journals in the past years, while for national journals levels B and C, just 4.2% of the sample have published up to four papers in each of these categories (see Table V).

TABLE V
FREQUENCY OF NUMBER OF NATIONAL CIRCULATION PAPERS

Number of papers	Frequency (% of Professors)		
	Level A	Level B	Level C
0	83.2	95.8	95.8
1 to 4	16.8	4.2	4.2

In the local circulation category just 11.5% had this kind of publishing as part of their work and out of this percentage, only one or two papers were published in local journals level A.

VII. Quality indicators for evaluating teaching

The questions used in the teaching evaluation survey have already been presented and numbered in the methodology on page 2.

In Table VI the proximity between the average and the medium shows that the distribution does not lead to discrepancies except for the question 5, which asks about the test quality, where the lack of attention of some students changed slightly the result because they graded zero in subjects that did not have tests.

TABLE VI
MEDIUM AND AVERAGES OF THE TEACHING EVALUATION INDICATORS

Question	Average	Medium
1	6.69	6.8
2	7.24	7.4
3	6.65	6.8
4	7.16	7.5
5	6.16	7.0
6	6.59	6.6

ANALYSIS OF RESULTS

The data was analyzed using descriptive statistics, with techniques of frequency analysis, as well as inferential statistics, exploratory factorial analysis and discriminating Kruskal Wailis analysis, using the software SPSS version 13.1.

The professor scientific production was pondered and summed (Table VII), using the *Qualis* criteria.

TABLE VII
CRITERIA FOR PONDERATION OF THE PROFESSOR PRODUCTIVITY

Journal's Level and Circulation	Ponderation Weight
International A	24
International B	12
International C	6
National A	12
National B	8
National C	6
Local A	8
Local B	4
Local C	1

The concluded supervisions were pondered and summed as well (Table VIII):

TABLE VIII
CRITERIA FOR PONDERATION OF CONCLUDED SUPERVISIONS

Type of Supervision	Ponderation Weight
Doctorate	4
Master	3
Scientific Initiation	2
Undergraduate Work	1

Arithmetic averages of the grades extracted from the teaching evaluation survey were used as variables for comparison and analysis.

From this modeling and data codifications, the analyses were done as follows: for the analysis of the adherence to a normal distribution in order to diagnose the type of hypothesis test to be employed (parametrical or non-parametrical), the Kolmogoroy-Smirnov test was used in Table IX.

TABLE IX
ONE-SAMPLE KOLMOGOROV-SMIRNOV TEST

	Scientific Productivity	Teaching Evaluation	Concluded Supervisions
Kolmogorov-Smirnov Z	2.110	1.623	1.423
Asymp. Sig. (2-tailed)	.000	.010	.035

I. Hypothesis Tests:

The variables tested were: scientific productivity, teaching evaluation and concluded supervisions. The categorical or nominal variables were: gender, CNPq scholarship, degree, career time.

When the categorical variable had two levels, the Mann-Whitney test was employed (equivalent to Student's t test) and when the categorical variable had three or more levels, the Kruskal Wallis test was employed (equivalent to the non-parametrical test ANOVA). As criteria for the analysis of results, different levels of significance were considered (α), that varies from 0.05% to 5 %.

The p-value was used in order to designate the significance of the results. When $p>\alpha$, the test is not significant, that is, there are no differences between samples, therefore the Ho (Nule Hypothesis) is accepted. When $p<=\alpha$, the test is significant, which means that there are differences between samples. Therefore, Ho is rejected.

In all cases, the Nule Hypothesis (Ho) admitted is that the samples are equal.

The hypothesis tests were used in order to answer the questions formulated in this paper's introduction.

As to the first question, that is, if professors that receive the scholarship from the research promoting program have greater scientific productivity or more concluded supervisions compared to the others, the fact that the research support is an important factor to the development of science can be observed.

By the Mann-Whitney statistical test, it is possible to observe that the professors with the scholarship have greater scientific productivity and have supervised more students.

TABLE X
MEAN RANKS

	CNPq Scholarship	Mean Rank
Scientific Productivity	No	44.06
	Yes	56.97
Concluded Supervisions	No	43.70
	Yes	57.67

As to the second question, if the highest qualified professors have greater scientific productivity and more concluded supervisions, this relation proved to be positive, that is, the highest qualified professors have supervised more students and produced more since 2001.

TABLE XI
SCIENTIFIC PRODUCTIVITY AND CONCLUDED SUPERVISIONS

	Degree	Mean Rank
Scientific Productivity	Doctor	42.32
	Above doctor	57.93
Concluded Supervisions	Doctor	43.54
	Above doctor	56.07

As to the third question, if more productive professors and the ones with more concluded supervisions would obtain better or worse teaching evaluation grades, the Mann-

Whitney test did not show any statistically significant differences. Showing a lack of relation between teaching and researching criteria.

When trying to establish differences between teaching skills of professors that publish more and supervise more undergraduate and graduate students three questions related to teaching skills from the survey answered received special attention, these questions were the one where the student had to grade his/her professor's didactic, the professor's commitment to the discipline and if the student thinks he/she is learning the subject.

The means were made for the teachers with different degrees and teachers with or without the productivity scholarship from CNPq, since the professors that have a degree above doctorate and professors with the scholarship are the ones with greater productivity and number of supervisions concluded. (See mean ranks on Table X and Table XI)

One can notice on Table XII and Table XIII that the means for the first, second and seventh questions from the teaching evaluation survey, do not show differences greater than the actual standard deviation for professors with or without scholarship and with doctor degree or above.

This leads to the conclusion that the teaching skills do not vary in accordance with researching skills therefore, the variables of teaching quality must be different from those of productivity and research quality.

TABLE XII
TEACHING GRADES MEANS AND STANDARD DEVIATION FOR PROFESSORS WITH DIFERENT DEGREES

Professor's Degree		Question 1	Question 2	Question 7
Doctor	Mean	6.942	7.526	6.826
	Standard Deviation	1.7016	1.3656	1.2663
Above Doctor	Mean	6.124	6.747	6.184
	Standard Deviation	1.6607	1.5327	1.0747

TABLE XIII
TEACHING GRADES MEANS AND STANDARD DEVIATION FOR PROFESSORS WITH OR WITHOUT THE PRODUCTIVITY SCHOLARSHIP

CNPq Scholarship		Question 1	Question 2	Question 7
No	Mean	6.827	7.410	6.598
	Standard Deviation	1.7419	1.4915	1.2594
Yes	Mean	6.215	6.848	6.515
	Standard Deviation	1.6422	1.3998	1.1861

CONCLUSION

The professor's role in its full complexity is an interesting issue, for the studied sample publish a lot in international papers, promoting the Brazilian researches around the world and demonstrating their intensive connection to worldwide researches.

However, an important observation must be made here, as the papers on exact sciences are usually easier to be considered international in contrast to papers in the human sciences.

Still, these researchers almost never have their role in the classroom evaluated. And it is clear that the criteria for evaluating researchers are not enough to evaluate professors.

It may be observed that the professor evaluation as it is done nowadays, using only or almost only research indicators, does not show correlation with the teaching quality indicators. That may lead to the conclusion that the principle of indissociability between teaching and researching in the Brazilian university, as mentioned in the introduction, cannot be implemented by legislation.

Therefore, the evaluation of professors' teaching skills is needed to fulfill the model imposed by the legislation. And a broader discussion to find the right teaching indicators is necessary.

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