Players of Social Responsibibility in Engineering Professional Education in Brazilian – Scenario SINAES – National System for Superior Assessment

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Abstract **Recently Brazilian society has claimed for better superior education system and Government answered with SINAES. This has been also, a special decade for educational institutions to change, as they all were obliged to undergo a deep *curricula* reformation, oriented by the so called pedagogy of competence - somehow fuzzily depicted for many scholars in engineering world. SINAES demands self-evaluation and self-reorganization. Meantime, social responsibility appears as global demand and, particularly for Engineers, is compromised with deeper perspective of sustainability. In this article, the authors discuss the experience in a Federal Government technological university conducting engineering under and graduation courses in this particular unfinished bend of history. The obligation to self-evaluation includes one committee in each institution, in charge of creation, implementation and management of indicators for the assessment process. This is the Gordian knot of institution reality and the material object of interest for this paper, where are present the absence of clear professional profile consensual definition, the crisis between tradition and modernity in teaching and managing, the delicate balance between emancipation and regulation rationality and also, the major conflict of interests between the liberal model of economy management and the social development public police approach.**

Index Terms – Education Assessment, Social Responsibility, Engineering Education, Interactive Methodology

INITIAL CONSIDERATIONS

The concept of social responsibility [1], from a humanistic perspective, can be considered as universally applicable to all social activities fields and therefore, it is an object of interest to all professions.

The repercussion of such interest in engineering field of actuation is, however, proper.

The capacity of Engineer to transform Nature landscape and to be the player that synthesizes the conceptions and projects coming from diverse fields of knowledge and in the end, materializes artifacts and establish productive organizations, makes him the indispensable subject of any productive action intended to be socially responsible [1].

The education of Engineers, despite the peculiarities of national education systems, kept, until the end of last century, straight and almost universal commitment with scientific positivist rationality [2] sheltered, almost ever, in a rigid structure of disciplines to be crossed through in a linear continuously manner, that is a curriculum

As guardians of the pathway, contributed professors specialized in exact sciences and, mainly, and teaching Engineers. The first ones entrusted of mathematical language acquisition and physical phenomena modeling. The latest, responding for application and refinement of such models appropriated to professional problems approach, upheld by sound experience consolidated in practice. Although still present and in general dominant, this kind of academic education has been suffering more clearly along the last two decades social pressure to change

The basic scientific knowledge and the domain of technologies to professional exercise are still expected characteristics of Engineers, but, there is a demand for more on their actuation in Society. This expectation has implicated into deep changes in their education, especially when it is oriented to professorship.

In such context, the critical view of present production systems and the concerns about environmental future have valorized the culture of sustainability for everyone's education, including Engineers.

It is over this back-cloth that is cut the object of interest for this paper to introduce the ongoing experience placed in one CEFET in Brazil. The chased moment is one in special, in which several vectors compete to change engineering education inside a traditional and highly recommended government educational institution. The discussion and the questions arose, however, detain similarities with equivalent processes in other latitudes and nationalities and it is expected, can be a valid contribution to education of Engineers in a general sense.

SUPERIOR EDUCATION IN SOCIAL AND ECONOMICAL CONTEXT OF BRAZIL

Brazil was ruled between 1992 and 2003 by a clearly neoliberal social and economic project. In this period there was a remarkable reduction of State and a generalized enterprises privatization process with Brazilian public funding. This process affected dramatically Brazilian

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economy with reduction of employment, in general, and particularly for Engineers. The stagnation of economy and the reduction of Brazilian industry in 80 and 90 decades made interest on engineering carriers drop down to a level never seen before in selection processes for admittance to most traditional institutions. The high costs for personal maintenance, massive dedication, difficulties inherent to domain of exact matters, long term of under-graduation courses and low employability together empted many engineering courses. On the other hand, privatization of state services affected specially health and education areas [3]. Superior education in Brazil counted in 2000 2,694,245 inscribed students, 67% in public and costless institutions and 33 % approximately in private institutions net. In 2004, the number of registrations was 4,163,733 distributed 72% in private net and 28% in public net approximately. These figures demonstrate not only, the expansion of registrations (approximately 55%) but also the roles inversion between State and private initiative in superior education. In this context 500,000 available places remain unfulfilled in the whole country [4]. At this time a large amount of senior professors and researches retired prematurely, leaving the best universities afraid of loosing their labor rights. These losses' recovering was not authorized by the federal government. There was, also, stagnation in the number of places offered in public courses and, in counterpart, stimulation for private institutions to expand infrastructure and multiply courses. The neoliberal project contributed also to modify superior courses structures. Until then they were obliged to offer and follow a grid of disciplines with contents and number of hours standardized for the entire country. Since then, it was adopted, by law, the competence based education planned to complete operation in the next decade [5]. According to labor law, Engineers were authorized to work in one professional specialty depending on the disciplines present in the official curriculum. As the curricula were standardized, the specialties for professional accreditation purposes were standardized too. The competence education, however, allows great flexibility to curricula composition what made professional specialties standardizations unfeasible.

Additionally, it was no more possible to attest the conclusion of professional preparation merely by verifying the coursed disciplines of the student curriculum. These changes have determined deep reorganization in Brazilian professional accreditation system CONFEA/CREA [6].

SINAES CONCEPTION AND GUIDELINES

The proliferation of institutions and superior education courses worried civilian society in general and, with the change of Government in 2003, the Ministry of Education emphasized implementation of national assessment program, called SINAES [7].

SINAES is an assessment system based on solidarity and cooperation inside and among institutions and not on competition ideology raised by personal success.

Education is treated as social good and not as commodity. In other words, the evaluation herein understood help to construct a new conception of superior education, socially engaged through the own objectives and functions

As one system, SINAES must articulate, in special, two important dimensions: educative evaluation itself and regulation. The first dimension is characterized by formative nature and turned to attribution of values judgment and merit in order to improve quality and the capacities of emancipation. The second is related to the functions of supervision, control, concrete authorization decisions, accreditation, re-accreditation, institutional transformation, etc, which are accepted as typical State duties.

SINAES unfolds in operational terms into self-evaluation activities conducted by each institution and external evaluation in charge of members of Academy and Government. CPA is a committee for self-evaluation organized in each institution and is entrusted of planning and implanting a self-evaluation system. The system must respect a minimum set of dimensions, but there is freedom to choose and treat performance indicators related to the predetermined dimensions.

This evaluation model presently in progressive implementation in Brazil was studied by the authors during the last years, as professors and members themselves of the CPA in CEFET/RJ.

SINAES has been raised inside a government project that valorizes the State social role, but is troubled with the legacy of the so called pedagogy of competences implementation results. This process is found in all courses, through the legal statements in the political-pedagogic projects. This pedagogy implementation is, however, incomplete and many times not perfectly understood. There is also great similarity among the structure of SINAES and structures belonging to other systems in which prevail the management logic and the concern with results goals to be reached. These ideological contradictions feed the tension between the proposal to educate citizens and another oriented by the commitment with the mapped demands of market. This is an important question to Brazilian institutions dealing with construction and implementation of their own evaluation system.

On the other hand, the current government has invested during the last years in strengthening public institutions through larger budgets, teachers and support staff recovering and authorization do expand and create infrastructure. In this context there is a net of federal government institutions called CEFET [9] distributed along the whole country and compromised with technological education. This paper is focused in CEFET/RJ placed in Rio de Janeiro city.

CEFET/RJ SINGULAR MODEL OF TECHNOLOGICAL SUPERIOR EDUCATION INSTITUTION

The history of CEFETs is bounded to the origin of professional education in Brazil. In 1909 President Nilo Peçanha created the so called Artificer Apprentices Schools in all states capital cities in order to provide public and costless professional education. In 1978 was created in the former capital city of Brazil, Rio de Janeiro, the CEFET/RJ. [9].

The discussion about Engineers education aggregate other values in Brazil when CEFETs are involved. This is because these institutions are unique in kind. The Engineers from CEFET/RJ deserve clearly differential recognition from working market in comparison with traditional universities egresses [9].

CEFETs are different from each other in size and profile. CEFET/RJ from Rio de Janeiro, the RJ in the end, will be briefly introduced. In this center, requested annually by more than 20,000 people, each year, are offered technological education in several different courses: high-school (3 years), technician (4 years), technologist (3 years), engineering (industrial-mechanical, electronic, electrical, management operations, 5 years) industrial administration (4,5 years), post-graduation (Master in Technology, 2-3 years and Master in Mathematics and Science Education, 2-3 years) [9]. This structure is far more complex and comprehensive than the majority of universities, colleges (EUA), fachhochschulen (FH), technischen universitäten (TU) (GER) and technical universities (U-TECH) (EU, EUA). In this moment the transformation of CEFET/RJ into a technological university is being analyzed accordingly with the model of specialized university expected in Brazilian federal Constitution.

The costless public education of great quality is attractive for adult and mainly young people from all social classes, as can be observed in the growing number of applications for the regular admittance processes, traditionally very rigorous and competitive. The Engineers graduated in CEFET/RJ are requested by local and national productive sectors, purchasing good jobs in private and public places. This professional success seems to be related to scholar staff profile and very efficient infrastructure of laboratories. This quality education allows egress Engineers to continue academically through post-graduations courses in Brazil and foreign countries, successfully.

In Table I are disposed the set of courses and respective number of registrations of CEFET/RJ.

TABLE I

COURSES AND STUDENTS

Course Type	Quantity	Students
High School	03	2.275
Technician	26	4.455
Technologist	03	429
Undergraduate	09	2075
Master	02	126

PLAYERS OF SOCIAL RESPONSIBILITY: THE ENGINEERS OF CONTEMPORANEITY

The crisis of identity enclosing many professions, engineering included, is bounded to the way and rhythm the contemporary Society construct and utilize knowledge. In such milieu, the concern about socio-environmental conditions affected by human action has contributed to evidence importance of concepts such as social responsibility.

In Brazil, legal reformation of engineering courses has introduced [5] curricular directives which determine the Engineers to have:

"education generalist, humanistic, critic, reflexive besides critical and creative actuation considering political, economical, social and cultural aspects, with ethical and humanistic point-of -view."

On the other hand, SINAES determine that:

"The educative evaluation must question the meanings of education and knowledge produced related to national development, the advance of Science, the active participation of individuals that build up the community of education in social and economical life. The educative evaluation distinguishes itself from mere control, because the questioning, judging and knowing processes are proposed, mainly, to improve accomplishment of institutional compromises through the elevation of pedagogical conscience, scholar professional capacity, knowledge production and critical analyses of the whole institutional practices and dynamics."

In this scenario in which people education must have ideologically primacy over their mere professional preparation to be integrated to work market, what should be the Education compromised with social responsibility exercise?

The concept of social responsibility herein adopted is associated with the idea of "Sustainable Development" developed by the Brundtland Commission and accepted by the 1992 United Conference in Rio de Janeiro. Many of the activities associated with social responsibility reflect sustainability's three dimensions – economic, environmental, and social – concepts described as sustainability.

METHODOLOGY FOR ANALYSIS

The authors have developed during the last years researches about institutional evaluation and, particularly, the level of satisfaction of students in CEFET/RJ with quantitative and qualitative methodologies [11], [12]. In these researches was used a three-axis system enclosing the agents (scholars, students and support attendants) that contribute to collective performance. SINAES proposal allow, somehow, taking advantage of this experience and the authors were invited to joint the CPA of CEFET/RJ.

This commission is a space of interaction to scholars, students and attendants in order to develop criteria and indicators to evaluate the several dimensions expected in SINAES.

The effective participation of the authors in discussions and construction of facts establishes the interactive observation methodology in which the teacher working experience is fundamental to the analysis purposed.

The focus of observation is intentionally dislocated from the evaluation system itself and its operational procedures, to frame the set of values externalized by the diverse agents involved.

The purpose is to understand personal and collective speeches, proposals, history and behaviours in order to depict cultural institution perspective at special moment when people are stimulated by external change vectors.

The discussions and observations about the results inside one group of researchers are the basis for the narrative of this paper.

The CPA and regular scholarship departments meetings as well the narratives of students and professors in several different opportunities were taken as locus for researching. Official documents like Project for Institutional Development (inclosing strategies for actions during each period of 4 years), SINAES and CURRICULAR DIRECTIVES FOR ENGINEERING COURSES, among others of local relevance were analyzed in details as additional reference elements.

SOCIAL INSTITUTIONAL DIAGNOSIS

The systematization of observations collected permit to indicate the following facts:

Almost all teachers, including the ones granted with doctorate diploma, were graduated in exact sciences carriers. The staff teachers have had no preparation or any training as professors. Their behaviour as teachers were not the result of explicit pedagogy knowledge or training, but the product of empirical practicing in engineering milieu, under the influence of other's exemplification.

Among the staff professors, predominantly Engineers, the discussions about possible correlations between daily teaching practices and the whole institution pedagogical project seem to be less attractive. This group has the tendency to consider the discipline space of work and the project of Society as different worlds, unconnected.

The language and logic used in institutional projects conception seems to awake in these professors the tendency to classify reflexive education as theoretical and bureaucratic, as well to consider it superficially during execution of regular operational procedures related to courses and discussions about education administration.

This, certainly, impacts educational projects for students, placing in opposite sides, traditional disciplines and those turned to a more comprehensive humanistic education. Space and time are shared competitively.

One profile for Engineers' education could not be clearly established. The debates related tend to be oriented by previously lived experiences rather than a future projection.

There is still dissociation between short and long term perspectives about competences and skills for professional practice. The immediate demands of firms and jobs placed in one side and citizenship education leaved in another. This seems to be strongly identified to the students own interests, the concern and motivation for pragmatic learning of technologies and employability of everything they are introduced to.

The pedagogy of competences preconizes an education pathway different from disciplines structure, but the word discipline seems to be some kind of inexpugnable archetype. It can not be avoided whenever the space and contents of educational activities are to be discussed in university environment. For education administration purposes the performance of each professor is still described, controlled and evaluated in terms of disciplines under personal responsibility.

The incompetence to substitute this single word that is capital to the traditional academic conception corresponds to the difficulties to substitute an existing structure by another not yet clearly established.

The professors edifice ideological walls around disciplines, confining teaching practices inside a private spaced ruled by personal views about the importance of a particular matter or knowledge to Engineers education. For joint work with projects involving several "disciplines" these walls are natural barriers.

Time exiguity and the multiplicity of teaching and researching tasks do not favor social contact of the collective of professors in departments or other units neither open common analysis about more comprehensive themes. The dynamics of routinely administrative meetings seems not to be enough for critical conscience to trespass such thick walls.

The traditional architecture based on disciplines grid and one unique logic sequence to cross it lineary and continuously conflict with the proposals of education through competences alternative activities.

This conflict tends to be solved with some kind of disciplines reformation, in order to modernize and reorganize names, contents and relative positioning inside the curriculum, but never, to substitute their traditional architecture.

When thinking in performance indicators applied to professors or students, the existence of such a disciplinary grid turn it very difficult to avoid fragmentary observation of players to evaluation purposes.

The well succeed experiments involving projects and integrated activities with some professors are still insipient, not well known and poorly recognized. When one pedagogical activity with interdisciplinary logic consolidates, in absence of other available alternatives, there is the risk to generalize and use it as universal Panacea to attend, at least in appearance, the demand for modernization and legal adequation.

The logic of disciplines fragments the view of professional education as if it could be like a chain, composed of links put together, from beginning to the end. Each link can be added just after the previous e before the next, in one unique proper order and time. Each professor is in charge of his own link and concerns himself about best near neighborhoods. Rarely the performance of the entire chain is object of understanding and involvement for each professor. The conception that no chain can be stronger than the weakest of its own links seems to encourage individual efforts of teachers in spite of cooperative team work.

The logical and numerical education of the majority of scholar staff seems to impose somehow one kind of rationality focused in results and, mainly, in numerical comparability of any result.

This tendency associated to disciplines fragmentation make it difficult to reach any consensual understanding about a more comprehensive identification of involved processes

and consequently how should be an evaluation focused in processes.

The emancipatory component of evaluation seems to conflict with the existing models for decision making. The current procedures are organized with a common expectation for rapid regulations and for goals of easy visualization related to quantitative indicators of performance. The discussion about qualitative indicators involving groups of professors and focused in the processes with which they interact seems to be particularly uncomfortable for those feeling themselves owners of "their disciplines".

There is a recurrent speech that this type of evaluation is excessively subjective and because of this, objective results upon which any work to improve institutional performance can not be purchased. On the other hand professors find it difficult to recognize the level of subjectivity with which they organize the own disciplines, attributing personal values to the contribution they represent to whole graduation of students.

Eventually, when the professors are asked to evaluate and criticize the work of colleagues, an ethical dilemma appears. If anyone, although does not admit it, acts subjectively, how to justify, objectively, the necessities for changing others teachers behaviours? In this sense, evaluations based on results, said to be objective, can be used politically as a manner to frame the professional behaviour of colleagues. In spite of the direct speech among equals, indirect speech of students and other agents can be heard and used as a source of objective indications for changes.

The students perceive, in general, the process through another rhythm. The institutional landscape is crossed as if it was a long corridor in the way to professional destiny. The structures, disciplines and practices of professors are like doors in the walls. According to this perspective each stage, each step is one less and not one more. This expectation demands terminative evaluations that can provide liberating momentaneous results. The long term process view is not the general rule among the students. They seem, also, to face their own conflict between objectivity and subjectivity. The activities, for instance that offer larger spaces to creativity and self-identification with personal motivations and, as counterpart demand particular dedication and production of individualized results, are targets of complaining about lack of objectivity.

The ideological tension between the project of sustainable Society and the major economical model present in Brazil can be seen in this situation. The hurry to acquire competences for immediate access to job market prevails as a characteristic of many Brazilian young people that have to work early to survive. Many of them begin to work during graduation or start practicing/training periods that are actually dissimulated jobs. The duties and the dedications in such cases are, sometimes, far beyond apprenticeship purposes and compete against academic activities weakening student's performance in university. There is other group of students that, for many reasons, pursuit another relationship with academic milieu. They are interested in longer permanency in school and take effective part in projects and researches under near scholar's guidance.

There is a clear distinction between these two ways students choose to complete graduation courses. The first case is destined to job market immediate consume. The last case configures a customized graduation replete of personal choices and experiences more reflexively lived.

The both pathways have place, theoretically, in the same environment, under the same rules, however, provide educative experiences definitively different.

When social economic factors that oblige some students to work for own maintenance or to help the family are excluded, the choice between the two alternatives of graduation depends uniquely on the set of personal values and the live projects. So it happens that many students that could involve themselves with a differential graduation opt no to do it. Meanwhile, there are students that sacrifice themselves to engage in complementary academic activities, as the personal resources for self-standing are insufficient even in costless courses of CEFET/RJ,

In the scholar's side the panorama is quite similar. There are professors that conceive engineering education as a standardized pathway. There are others that invest in more selective interaction with students through academic projects that are beyond the routinely activities in discipline plans.

The two behavioural movements occur simultaneously facing each other ideologically in many events. At moments of common decisions making like this of actual self-evaluation implementation, such conflict is even clearer.

In this context, considering the observations presented about relevant players, how could it be possible to deal with social responsibility concept?

SOCIAL RESPONSIBILITY AS COMPETENCE?

When the concept of social responsibility is thought relatively to citizenship exercise and particularly the professional facet, it can not be lost that every single attitude is net-connected to many others, inside one multidimensional chain of significations and re-significations with practical consequences that develop in different times.

The critical reflection about action and reaction in such context is by definition cross-disciplinary and request a very sophisticated and complex perception that is very unlike to be elaborated in fragmentary quantitative models.

The competence of human beings to behave this way while in professional exercise systematically and securely seems not to be born in any sequential or cumulative logic of disciplines, neither to be purely consequence of any theoretical knowledge accumulation about technical standards, legislation or texts about ethics.

The development of this competence, not restricted to professional practice, but comprehending the whole of actions and relations in Society, suggests a deep reflection about concepts like education, ethics, sustainability and inevitably, about what and who the educators are.

Generally, decision processes concerned to social responsibility depend on the views about action and reaction and cost benefits known and recognized relations following some kind of values scale. It is proper from human knowledge dynamics and also highly desirable that this space for decisions can incorporate more and more dimensions.

Engineers in order to conceive and manage professionally projects, artifacts and sustainable organizations are demanded now and will be even more in future to have high capacity of cognition and judgment about a multi and interdisciplinary basis of knowledge. This complex capacity can not be provided by any existing universal graduation course. Aesthetical and emotional perceptions can not be excluded from this capacity that is to be developed in social responsibility field.

In this n-dimensional space, knowledge is constructed by the whole of existing professions and correspondingly, the professions are formed and reformed due to knowledge constructions. This fact points to unfeasibility of solitary working processes. The professional roles that in the past were culturally and legally frontier, articulate now, generating cross-disciplines and inter-subjectivities with important consequences for professional competences conceptualization.

When the concerns are about education of people for professional exercise in such an environment, the ideological tension between competitiveness in the market and cooperativeness in Society seems to be inevitable

FINAL REMARKS

The Engineers that Society wants to see acting responsibly in the future are the young people from today that must be educated in general and professionally with social responsibility not only as an object to study, but something for life styling.

The Engineers that Society wants to see articulating several fields of knowledge and communicating to other social players to purchase the best decisions are the young people from today that must experience articulation and social communication along their education to be adults and professionals.

Considering the researched facts and the observations presented it is necessary a high sense of social responsibility to instigate and sustain a deep transformation process affecting scholar's individualism and institutional conservationism to make it possible a better pattern of education to future Engineers.

The educational institutions, as well productive organizations face challenges of sustainability pursuit. It is mandatory that professionals in charge of education overcome the necessities of changes and doing so, contribute theoretically, ethically and pedagogically to educate people observing them and that traditionally copy their behaviour as examples of social responsibility

The entire process is not easy neither obvious because there is no defined form as an option to be adopted in a fixed time.

The implementation of competences pedagogy illustrated this situation. No academic institutional life different from the centenary existing model could be clearly established, yet many members of academy manifest their criticism and declare interest on alternatives to status quo.

The discussions involving educators and changes in education must somehow be analyzed and represented differentially for engineering world, as well for each professional particular world. The obstacles for understanding and assimilating new social representations are the first to be defeated in order do accomplish social institutions reformations. The engineering identity, the own traditional education and professional practices are no exception.

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