The Engineering Professional and the Labor Market Demands: Electronic Engineer and Mechanical Engineer

Aldair Oliveira de Andrade¹, Antonio Marcos de Oliveira Siqueira² and Lucas Henrique Figueiredo Prates²

1. Instituto de Educação, Agricultura e Ambiente, Universidade Federal do Amazonas, Humaitá 69800-000, Brazil

2. Department of Chemistry, Universidade Federal de Viçosa, Viçosa 36570-900, Brazil

Received: May 26, 2014 / Accepted: June 06, 2014 / Published: July 25, 2014.

Abstract: The purpose of this study is to present results of a jobs classified survey from a newspaper in circulation in the city of Manaus (AM, Brazil), between late 1990s and early 2000s. The structure and functionality of the CBO (Brazilian Occupational Classification) 2002, fundamental tool for data analysis was used, followed by collection, diagnosis and data analysis to identify the characteristics and transformations of the occupational tasks of the electronic and mechanical engineer. The analysis was based on CBO data in three distinct steps described in the methodology section, compared with a study conducted in the early 1990s, and finally, the overall prevailing trend required in professional engineering training in times of complexity and in the knowledge era was presented.

Key words: Engineering education, occupational profile, Brazilian classification of occupations, skills and abilities.

1. Introduction

The discussion raised in this study is on what is fundamental to the professional formation of an engineering student: (1) technical knowledge concerned with execution of the occupation, considering the great amount of information he needs to dominate, with course program focusing exclusively on that; (2) or formation not so focused on grueling technical information, in other words, professional formation offering an engineering student not only finished knowledge, but also the chance of learning to build and create knowledge, through a fundamental change in posture, in which the student learns to learn.

Along with this, new posture is also the need of a less funneled professional formation, where the student could connect knowledge between areas that apparently do not have connections. In order to initiate this discussion, it is pertinent to mention two concepts, which are fundamental when considering professional

practice: qualification and competence. The authors' position discussed here is not unanimous, it is a reading and it is subject to rejection and criticism. Next, the results of a field survey are presented, referring to the profiles preferred by the market for electronic engineer and mechanical engineer, professionals very much required in the Industrial Pole of Manaus (AM, Brazil) and the confrontation of these profiles with what establishes the CBO (Brazilian Occupational Classification) [1] and the National Curricular Guidelines [2]. The paper is organized as follows: Section 2 discusses the change in the capitalist mode of production and the implications for the worker and the profile; Section 3 the concepts of competence and qualifications are analyzed; Section 4 presents the occupational profile demanded by the labor market for the electronics engineer and mechanical engineer; and Section 5 presents some reflections on the formation of the engineering professional, whether this duty to attend specialized training, more technical or a more humanistic education.

Corresponding author: Antonio Marcos de Oliveira Siqueira, professor, Ph.D., research fields: engineering education and labor market. E-mail: antonio.siqueira@ufv.br.

2. Conceptual Review

The Fordism mode of regulation and the Taylorist production system seem worn out to surpass the crisis, and the transition from this model to the entitled regime of flexible accumulation has begun, as a way found by capital to overcome the crisis initiated in the 1970s [3].

Although the transition from one paradigm to another should be thought of as a complex and contradictory process that evidences a crisis, and not the abolition of a model to another, the fact is that new technological bases introduced by the entitled "Third Industrial Revolution" (microelectronics and robotics, microbiology and new energy sources) provided the conditions for a productive restructuring sustained by the above-mentioned dry, integrated and flexible production. For being programmable and, therefore, flexible, machines based on microelectronic technology met the needs of the unstable market and allowed the recovering of yield profits, while assuring time and control saving, allowing optimizing resources and significantly reducing production time [4].

If all this process also brings strong work segmentation, which makes that integration and flexibilization do not reach all workers similarly, it can be noticed that some of its consequences affected organization, relations and work content in companies. In face of flexible automation as a form of resolving crisis, besides technological physical transformations, organizational changes were introduced: operational decisions were decentralized owing to the speed of changes; workers of all levels were constantly recruited to participate in this rapid innovation process, making decisions and facing random problems and unexpected circumstances present in this new system of production.

Therefore, it has been required from workers not only formal and explicit knowledge assured by the diploma, but also wide cognitive and behavioral skills, such as initiative, responsibility, autonomy, creativity, cooperation, leadership and flexibility to deal with

growing abstract and complex tasks.

The above-mentioned changes would be jeopardizing the work position and the specialized worker demanding a multitask worker. It is necessary to emphasize that these qualification contents currently required are not so new. Firstly, the scientific work organization does not eliminate the entire initiative and participation of the worker [4-6] not only because he, as a human being, cannot follow only hetero determined norms but also because, even without admitting, the capital needs working knowledge, its unplanned intervention, the called tacit qualification, to face unexpected production circumstances. Secondly, these characteristics today considered unusual were always typical of processing industries, but, as they did not serve as a model for the theorization of Fordism, their requisites in terms of qualification have been hidden in the academic and management imaginary.

The emphasis on multitasking, understood as a set of abilities that can face the complexity and unpredictability of the new system of production, means the transition from the concept of qualification to competence. Competence can be defined as the translation of these abilities into an initiative or assuming responsibility in face of productive events, which are unexpected situations that occur in production [7, 8]. Competence is, therefore, an attribute that relates to subjectivity of an individual, and to the capacity of mobilizing knowledge and the necessary attitudes for autonomously, resolving problems in a specific situation [9, 10].

According to Zarafian [7], it is necessary to emphasize three dimensions in the competence concept: participative competences, related to the capacity of the employed person of knowing the integral function of an organization; knowing how it works, the intervention in its context, participation in the redefinition of its structures; cross competences, related to team cooperation and networks of different sectors, which imply in understanding the integral

production process or service; social competences, which integrate the fields: autonomy, responsibility and social communication in future occupations.

Some of the main characteristics of the competence model concern its form of work organization and management: in the first case, control occurs through goals and results, and not through tasks, since prescription would be substituted by flexible work which, for this reason, demands subjective qualification aspects. In the second case, recruitment, remuneration and promotion within integrated and flexible companies would be carried out not by posts anymore, but by competences, which means dislocation of qualifications from the work position to the individual [11].

Specifically, competence expresses change in organization and in social relations; largely, it designates transformations in professional contents [7, 8]. It can be noticed that modifications in qualification contents cause change in its concept itself. This because qualification was, and still is, irrespective of Friedmann and Naville's conceptions, associated, by social practice and literature, to the Fordism mode of regulation and to the Taylorist production system, in which prevailed the work codification system based on classification of qualifications, which were identified as a set of formal, specific and inflexible knowledge, conferred by the diploma.

3. Qualification: Broader Than Competence

If Naville [12] sets aside several aspects that, in his time, there were not problems (unemployment, job insecurity deregulation of the labor market, etc.); and his definition of qualification as a social relation remains extremely current, as, in the wage earner regime (which separates the worker from his work), professional qualifications, that firstly relate to qualitative aptitudes, are appreciated by hierarchy in professional classifications, which quantitatively measure these abilities by salary.

Accordingly, for the wage earner, worker

qualification has to be related to work qualification, relation that is expressed as "opposition between crystallization of acquired qualifications and fluidity of required qualifications", which generates social contradiction, given that the worker considers his professional quality as a definite acquisition linked to his person and the industry, in contrast, requires constant involvement resulting from flexible needs [12], for its maintenance and reproduction. This is how the relativity of acquired qualifications occurs, which means that suddenly, qualifications may have no more practical meaning, losing its existence [12].

The fact of existing a dilution of job positions and occupations and existing new work practices beyond the formal employed worker that require more subjective attributes, does not invalidate this argumentation, i.e., it does not mean that qualifications lead, in fact, to individual quality, as human activities continue being evaluated by their economic value, in other words, they continue under the influence of wage relation.

In contrast, these changes may really imply a new type of classification. If, as demonstrated by Naville [12], classifications contain an artificial element and, therefore, do not correspond to the work performed in practice, this means that they are not inalterable, but constant object of disagreements on criteria crystallized in qualification hierarchies, both by employees and employers, even if for opposite reasons.

In other words, there will always be frequent adjustments for the redefinition of qualifications in new conventions, which are built and adapted to contradictory force relations present at a given place and historical moment, and which end up, thus, integrating private and divergent interests in a common vocabulary allowing conflict, exchange and cooperation [13].

This is how if competence was until the mid 1990s, a quite fluid and vague notion in the academic thought context [14]; this inaccuracy has been reverted by

some authors who try to better define it, among which Zarifian [7, 8] stands out. This author tries to provide a scientific statute to notion, through a multidimensional perspective: from one side, it refers to the capacity of taking action in specific and unpredictable situations, this capacity derives from practical intelligence supported by acquired knowledge which are transformed; on the flip side, it designates the fact of being recognized by the judgment of others, both social and financially.

In one word, competence is simultaneously taking responsibility (by self-initiative and not delegated) and the social recognition of this taking of responsibility. In these two cases, what matters is not only the knowledge background, but the autonomy manifested in the control of situations and recognition that this autonomy may bring about.

This definition expects, therefore, that companies change into qualifying organizations i.e., that they trust the responsibility commitment of their employees and compromise with the evolution of their professional progress. For Zarifian, privileging subjectivity does not mean, however, denying the social side: competence should not lead to an isolated individual, but to a network of communication and co-responsibilities, which would lead to a work group. Altogether, the author prefers to use the term competence, since the definition of qualification is restrained to the false dilemma between job qualification, which does not account to real work, and individual qualification, which does not include the dimension of recognition.

Despite this distended definition, the point here is that, from the theoretical point of view, qualification, as conceived by Naville, is not only far from being a static concept, that designates worker qualities provided by the diploma, but is also broader than competence, encompassing it since qualification covers social, economic, political and cultural aspects present in the classification and hierarchy of jobs and occupations.

If the employment separates the worker and his professional formation from his work, it means that, if qualification is in great part determined in the school system framework, it does not depend completely on school, since it cannot manifest and be sanctioned by itself, without association with work [15]. The equation between teaching, formation and qualification hides the fact that qualification is not a property conferred by the educational system to individuals, but a social relation that combines several parameters and is determined by the market [9]. An increase in formation requirements does not mean necessarily, an increase of qualification. Likewise, it is not possible to make learning a synonym of guaranteed job: there is a difference between learning mechanics and being a mechanic in a given company [15].

It is worth emphasizing that those aptitudes formed in school only become qualification when they are socially recognized, i.e., when they become useful to the society. As Naville [12] says, an occupation that loses all economic justification, stops representing a social value that was previously appreciated and considered.

If qualification is not a thing, a substance, says Naville [12], it is because there is no direct and objective way of qualifying a set of positions by merely technical reasons. It derives from there the idea that operations, tasks or work quality do not determine the way by which worker competences will be valued in terms of qualification [16].

A more complex work, which requires varied and elevated competences, will not be necessarily more qualified, as it may not have social, symbolic and/or financial recognition. That is, competences refer to workers attributes, but they are not responsible for their effective value.

Qualification cannot be reduced, then, to intrinsic properties of individuals, their aptitudes, skills and competences, as it depends on performance in the labor market, where social representations are concretized and end up conferring exclusiveness of

certain positions to determined segments.

Qualification may not only refer to individual attributes, as they normally have skills that they do not need or use at work. Competence is, therefore, only one of the qualification elements, and remains submissive to it, not only because it concerns individual aspects of work skills and, therefore, relates less immediately to social classification operations and hierarchy of individuals and jobs [17] but also because only when it is recognized and socially established, in social and monetary terms, it becomes qualification.

Accordingly, even assuming Zarifian's multidimensional perspective, in other words, even assuming that the notion of competence also holds the side of symbolic and monetary recognition, it is believed here that, from a theoretical point of view, that qualification broader to comprise the phenomena not only of the formal labor market, but also of the informal market and of unemployment.

If Zarifian believes that the definition of qualification is limited, it is because he only considers work or worker qualification, and does not relate them, as Naville does. If we follow the Navillean perspective, it can be concluded that qualification can cover individual dimension, individual competence, their qualities, and social dimension, the way of qualifying these qualities, of recognizing their value. Therefore, the definition of qualifications refers to a triple individual and collective challenge of competences acquisition and job access, work organization and job evolution, status and social consideration [13].

In contrast, even not agreeing with this posture, it is necessary to recognize, at least, that qualification does not need to be substituted by competence, since, conceived from a broader perspective, its concept can cover implicit, informal and unorganized aspects of individual characteristics. Moreover, the word qualification is still used, and even grammatically seems to be broader than competence, as, besides

noun and adjective, it can also be a verb; and to qualify seems to encompass social hierarchy processes, the act of classifying different work skills.

Anyway, the important thing to notice is that, qualification or competence, the work quality issue is, as well demonstrated by Naville [12], multiply determined, and its measurement in terms of qualification contains subjective aspects that cannot be reduced to a single measure and dimension. Qualified work, itself, does not have self-characteristics. In summary, qualification cannot be derived from professional formation time and/or work quality, as the social conception of an occupation, of a job, is as important for its classification as its content.

According to Naville [12], qualification varies in time and space, even during the Fordism mode of regulation, has different connotations according to place: the existence of an encoded qualification system in an occupational classifications grid that places individuals in a hierarchy according to job positions and professional field level is a typically French characteristic, which, as a matter of fact, provides the concept of qualification such relevance that does not exceed the frontiers of France [18].

Despite the French presence in the beginnings of the constitution of discipline in the country, its theoretical contribution was put out completely in the following decades. And today, although following and inspiring in the French contemporary discussion on the argument qualification X competence, in which Friedmann and Naville's theorization is strongly present, the academic discussion in Brazil practically does not know the contribution of both authors.

Pedrosa [19], while comparing several studies of Brazilian authors on work qualification concluded that more significant than the divergences on the qualification sense is the vagueness of the concept itself: recent Brazilian studies do not explicit what they define as qualification. However, if qualification and competence have strong symbolic legitimacy here and were and are introduced in work relations by

academic discussion rather than by daily life itself, it is necessary to theoretically know this debate, and not only its political results.

In other words, diffusion and symbolic legitimacy of qualification and competence cannot be confused with social practices of organization and work control. Anyway, recognizing that the French reality debate cannot be automatically transposed to Brazil does not mean that it has no meaning here, but that it must be recreated, due to our historical specificity (nature of labor market, characteristics of professional formation of a national working class, force and bargain power of labor unions, forms and material and symbolic expression of social hierarchies).

The fact of not having the above-mentioned collective employment and homogenization of salaries, for example, can make that the transition from qualification to competence becomes here synonym of higher deregulation of job relations, leaving workers more vulnerable. Consequently, in a context of strong unemployment, segmentation of labor market and flexibilization of employment contracts, it is even more important to recover the vision which affirms that qualification is built socially, in order to observe the strategies developed by different worker categories to be inserted or maintained in the labor market.

If the diploma is no longer a sufficient condition for insertion and maintenance in this market and if, simultaneously, the requirements on this topic and on the context of personal qualities continue increasing, expressed by the demand for multitasking, how is it possible to explain that this trend to higher qualification is not accompanied, in many cases, by salary increases? Furthermore, if qualified people cannot find a place in the labor market, it means nothing but that they are disqualified, given that certain qualifications without job (as it is the case of graduates who do not find the type of work corresponding to their diploma) are not, then, social qualifications [12].

The exhaustive argumentation on qualification

leaves gaps to the understanding that there is no consensus as for these two concepts both have relevant characteristics as for worker classification, although, the most frequent adopted concept is that of qualification, justified by being wider than competence.

As for the qualification concept, it was observed that it is required in the sources used in the present study, when analyzing occupational functions and specificities described in the Classified Job Offer ads, it is noticed the requirement “basic qualification courses” as complement to academic graduation.

4. Labor Market Demands and the CBO

In the sequence, observations from the field work performed from classified job offer ads in a newspaper circulating in Manaus city, between the late 1990's and early 2000 are presented. The structure and functionality of the Brazilian Occupational Classification [1] was used. The CBO established by the ministerial decree n. 397 of October 9th, 2002, has the purpose of identifying occupations in the labor market, for administrative and household survey classification purposes.

The electronic engineer registered at CBO 2002 under identification 2143-10 performs electric, electronic and telecommunications services, analyzing technical proposals, installing, shaping and inspecting systems and equipment, performing tests and assessments. He projects, plans and specifies electric, electronic and telecommunications systems and equipment, and also prepares technical documentation; coordinates investments and studies electric, electronic and telecommunications processes.

The professional practice of the electronic engineer requires graduation in one of the engineering areas: electric, electronics or telecommunications or technologist course in one of the areas, with registration at the CREA (Regional Council of Engineering and Agronomy). The full performance of occupation occurs, on average, after four years of

professional experience. Job maintenance in this field requires constant professional updating.

Electronic engineers work in varied economic activity branches. In the industrial area, they work in the manufacture of machines, appliances and electric and electronic materials and telecommunication equipment. Their activities are usually developed in a multidisciplinary team with occasional supervision. In some activities, they may be submitted to special work conditions, for example, excessive heights, high temperatures, intense noise, exposure to toxic material, high tension and radiation. Calculators, calibrators, computers and peripherals, internet, EPIs (individual protection equipments), measuring instruments, CAD/CAM/CAE software, texts, spreadsheets, database are some of the work tools of the electronic engineer.

From the database collected in this study, a broad range of expertise required by the employer, besides academic formation is observed. Among these specifications, the following desirable knowledge stand out: failure analysis, electric circuit analysis, electronic components, sound quality control, video quality control, standard time control, preparation of technical documents, preparation of technical procedures, hydraulics, introduction of new products, implementation of preventive actions, electrical measurements, microwave, sound microprocessor, TV microprocessor, monitors, pneumatics, language programming, repair electronic panels of CNC (computer numerical control), TV and video tape machines.

Such knowledge is supplementary to special formation for the execution of the occupational task. As for experience time, it is proved by the collected data that 52.9% of job offers present this requirement, and that the required mean time is 2.9 years, inferior to the mean required by the CBO, which is four years.

The mechanical engineer registered at the CBO 2002, under the codification 2144-05, projects systems and mechanical sets, components, tools and

materials, specifying reference limits for calculation, making calculations and designing. He implements maintenance activities, tests systems, mechanical and component sets, develops product manufacture activities and prepares technical documentation. He may coordinate and direct technical activities. The practice of mechanical engineer occupation requires graduation in mechanical engineering and similar with registration at CREA. The current market trend is to value professionals with post-graduation and specialization courses. On average, for full execution of activities, over five years of experience is required. In industry, mechanical engineers are employed mainly in maintenance, manufacture and project functions, composing multidisciplinary team, under occasional supervision.

The collected data from field work allowed identifying the knowledge demanded by employers in job advertisements: analysis of mechanical defects; failure analysis; stamping; plastic injection; stamping process; process of introduction of new models. As for the schooling required by CBO, the classified ads confirm 100% demand of higher education, as described by CBO 2002. As for experience time, it was noticed that 28.6% of analyzed classified ads presented this demand, and a mean time of 2.5 years for the execution of occupational task, somewhat inferior to that demanded by CBO 2002, which requires for full execution, five years of experience.

It is interesting to notice that the CBO requires a specific course in mechanical engineering, for full occupation execution. It was noticed the demand for courses on Fundamentals in Plastic Injection and Painting Process, necessary to the activity, also necessary to this occupational task. It is assumed, thus, that these are supplementary to the main professional formation and the additional required knowledge has correspondence to the complementary formation.

5. Final Considerations

The unanswered question is on the purpose

proposed by the curricular matrix for the professional formation of the engineering student. Is it a technical, specialist formation of competence for the performance of a determined task, or a broader formation that sees a little further, more focused on its own doing circles? As demonstrated, the market demand is for competence and, as a general rule, this is the tonic of curricular matrices aiming at forming professionals not for life, but for the labor market, in other words for the execution of a specific task.

The National Curricular Guidelines endorses that the professional graduating from engineering courses should have a generalist, humanist, critical and reflexive formation. In the basic part of the curriculum, corresponding to 30% of the credits in a minimum curricular program, the following topics should be addressed: II—Communication and Expression; XV—Humanities, Social sciences and Citizenship. However, it was not possible to explicitly identify in these two topics, the elements that lead to criticism or reflection.

In topics humanities, social sciences and citizenship, many areas can be mentioned, it ends up being mostly a decision of the Institution and of the vision of the Pedagogic Political Plan makers to include disciplines that really allow this criticism and reflection, such as Philosophy, Sociology, Critical Geography, Anthropology or even History. The study of Mishima and Balestrassi [20], also noted the demand for curricular formation, specifically social sciences, exact sciences. The author emphasizes that such demands do not encompass totality, representing only a piece of the totality demanded by companies. It is also worth highlighting that the English language proficiency skill seems predominant with a percentage of 80%.

The results of these surveys lead to questioning the academic formation itself, as for the necessity of a human, reflexive formation. In fact, a dilemma exists and needs to be resolved when one asks: are professionals formed in universities for technical

execution of a determined occupational task following the market demands, or for social life as a whole? It is believed that the attempt of responding to this question leads us to weighing which should be the necessary curriculum in the formation of these professionals. As it is known that one thing does not cancel the other, the time in university must be used to develop a humanistic formation that includes in its core the formation of human knowledge. In this environment, it is necessary to overcome the dichotomies and trenches built by the separation of sciences, biological, exact and human, as they all originated from the capacity of philosophical and reflexive speculation of men and not machines.

At the same time, it is also not possible to deny the importance of technical competence. It is undeniable that Brazil is among the developing countries with professional deficit in this area, in other words, even in face of the high market demand, this is not an attractive course. The common reason for that is that the course is difficult, in fact the undertow of a structural problem that comes from basic education, a poor background in all learning areas, from humanities to exact sciences. It is not possible to attribute this poor formation only to mathematics, physics or chemistry, the bad guys of exact courses, but in fact to a more complete formation. The Brazilian student from public school finishes school with basic deficiencies, like reading and reading comprehension; thus, it is unlikely that a student will have good performance in disciplines that require logical reasoning and interpretation.

In fact, to discuss the professional formation of engineering students, it is necessary not to look only at the tip of the iceberg, but to look at its base, the problem concerning professional formation; either for life or for the labor market is in elementary school formation. Elementary school formation must provide the necessary tools to develop the human capacity of learning, searching, creating. Hence, there is no magic formula; the Brazilian reality is not going to be easily

changed. This is not a specific problem of this occupation, all areas of knowledge present deficiency. Nevertheless, it is possible to be aware of the fact that it is not the matrix presented in universities that will determine the professional and his quality, but from concrete evidences of the Brazilian reality, that there are in fact historical liabilities in the curriculum that need to be corrected, a good beginning would be the introduction of disciplines in the first years of university that lead to the capacity of reflection and creation, and not the formation of an robotized individual who memorizes formulas and techniques, but does not know what to do with them.

Acknowledgments

The authors thank the support of the UFAM (Universidade Federal do Amazonas) and the UFV (Universidade Federal de Viçosa). The authors would also like to thank the logistic support of the FAPEAM (Amazon State Research Foundation), and of the FAPEMIG (Minas Gerais State Research Foundation).

References

- [1] Brasil, 2002. *CBO (Brazilian Occupational Classification)*. Brazil: Ministério do Trabalho.
- [2] MEC (Ministério da Educação e Cultura). Resolução CNE/CES 11, de 11 de março de 2002.
- [3] Harvey, D. 2005. *The Condition of Postmodernity: An Enquiry into the Origins of Cultural Change*. 14th edition. São Paulo: Edições Loyola.
- [4] Coriat, B. 1983. "The Regulation in the Current Crisis." *Les Cahiers Français* 209: 65-8.
- [5] Coriat, B. 1994. *The Workshop and the Stopwatch*. 3rd edition. Paris: Christian Bourgois.
- [6] Leite, M. P. 1994. *The Future of Work: New Technologies and Subjectivity Workers*. São Paulo: Scritta.
- [7] Zarifian, P. 1997. "The Competence and Production Models." Presented at the 21th Anais Congreso de la Asociación Latinoamericana de Sociología, São Paulo, Brazil.
- [8] Zarifian, P. 1998. *The Management and the Competence*. Rio de Janeiro: SENAI.
- [9] Tanguy, L. 1997. *Skills and Social Integration in the Enterprise*. Campinas: Papirus.
- [10] Tanguy, L. 1997. "Training: An Activity in the Process of Setting." *Veritas* 42 (2): 385-410.
- [11] Dubar, C. 1998. *Professional Identities*. Paris: The World of Work.
- [12] Naville, P. 1956. *Essay on skilled labor*. Paris: Rivière.
- [13] Lichtenberger, Y. 1992. *The Grade; Social Commitment, Productive Challenge*. Buenos Aires: Piette; Humanitas.
- [14] Hirata, H. 1996. *The Polarization of the Qualifications of Competency Model*. Petrópolis: Vozes.
- [15] Alaluf, M. 1986. *The Time of Labor*. Bruxelles: Université de Bruxelles.
- [16] Stroobants, M. 1993. *Competence Test Qualification*. Paris: Syros; Alternatives.
- [17] Tanguy, L. 1997. "Naville P. Introduction; Psychologist Sociologist, a Man Disturbing Science." *Educational and Vocational Guidance* 26 (2): 171-82.
- [18] Saglio, J. 1998. *Qualification and Classification*. Paris: The World of Work.
- [19] Pedrosa, J. G. 1995. "Comparative Analysis Based on Qualification and Changes in Work." M.Sc. thesis, Universidade Federal de Minas Gerais.
- [20] Mishima, E., and Balestrassi, P. P. 2008. "Requirements for Entering the Labor Market Provided Engineer Newly Formed." *Revista P&D em Production Engineering* 8: 13-30.