

COMPARATIVE STUDIES ON THE TEACHING OF "SUSTAINABILITY" IN THE PROGRAM COURSES OF INDUSTRIAL ENGINEERING FROM FIVE PUBLIC UNIVERSITIES IN BRAZIL.

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Abstract: The importance of exercising the learning related to sustainability emphasizes the justified interest in studying how the institutions in Brazil are building the teaching-learning process for the training of professionals capable of meeting the new challenges of working for sustainable development. To know how universities are organizing to form professional production engineering can promote sustainable development and the practical application of social and environmental responsibility in the labor market, we propose a comparative study of the programs. We selected five public universities in a different region of Brazil and analyzed your programs of courses production engineering. The menus of the subjects were compared between the universities and identified aspects of the practice of the classroom. We note that a preliminary analysis indicates that total hours does not provide hands-on activities in training programs and that higher education institutions surveyed in Brazil encounter difficulties in integrating theory and practice of sustainability to their students and future professionals in production engineering who will work for sustainable development.

Keywords: educacion, sustainability, production engineering, undergraduate course, Brazil.

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1. INTRODUCTION

1.1 Production Engineering in Brazil - Historical Aspects

The engineering industry emerged in the twentieth century in America began in Brazil as production engineering with the creation of the Institute for Rational Organization of Work in 1931, and only since 1959 that subjects specific to production engineering began to integrate the program other courses such as aeronautical engineering from the Technological Institute of Aeronautics (ITA). The graduate emerges in 1966 at the Pontifical Catholic University of Rio de

Janeiro (PUC-RJ) and was created in 1971 the first graduate course in production engineering from Universidade Federal do Rio de Janeiro (UFRJ). Currently there are 317 courses offered in the country at institutions of higher education between public and private (INEP, 2010). These courses in their curriculum organization basically conform to engineering courses in full production, which are those that comprise much of the workload in the study of production management, and courses with specific qualifications that divide the workload between studies of technical systems and management of production, resulting in engineering courses for electricity production, production calendar, mechanical production, among others.

1.2 The Formation of Production Engineering

The Ministry of Education through the National Education Council (CNE) and the Higher Education Council (ESC) provides the CNE / CES 11/2002 in his art. 6, which all engineering course, regardless of their discipline, must have in its curriculum a core of basic content, a core of professional content and a core of specific content that characterizes the discipline. The core is the basic content that establishes the nature of knowledge engineering. This body of knowledge allows the engineer to develop competencies and skills to understand a structure to be created or existing in terms of its various components. The core professional content is what makes the combination of theory and practice of knowledge acquired at the core of basic content. And the core of specific content constitutes extension and deepening of the contents of the core professional content, as well as other content designed to characterize modes. These contents, consolidating the remainder of the total workload will be offered exclusively by institutions of higher education. There is a differentiation of disciplines such as: compulsory (elective, according to the focus) and complementary (non-compulsory subjects). To subsidize the possible analysis was considered useful to describe the curriculum organization and groupings of content within the curriculum for graduation.

1.3 Profile of the Manufacturing Engineer

As usual definition used by both the American Institute of Industrial Engineering (AIIE) and by the Brazilian Association of Production Engineering (ABEPRO): "It is for Production Engineering design, implementation, improvement and maintenance of integrated production systems, involving men, materials and equipment, to specify, predict and evaluate the results obtained from these systems, using the expertise of mathematics, physics, social sciences, together with the principles and methods of analysis and engineering design." (ABEPRO www.abepro.org.br).

The graduate course must have a solid scientific and professional general to enable him to identify, formulate and solve problems relating to the activities of design, operation and management of work and production systems of goods or services, considering aspects of human, economic, social and environmental issues, with ethical and humanistic vision in meeting the demands of society. Among these challenges, it requires the learning necessary to account for the productive management with environmental sustainability.

1.4 Components of the course curriculum of industrial engineering - research background

Furlanetto et al. (2006) conducted a search on specific core content of the courses of engineering and production among the topics selected were searched contents on Environmental Management and Ethics and Social Responsibility, on which it was found that "... only about a third of the courses have evaluated specific curriculum components to address them. " This research was performed in 48 courses and the sample for 25% of registered courses in the INEP in 2005 and the results, he says that "... we conclude that, in general, the selected topics are being treated very timid by the various courses that compose the sample in this research, leaving a first impression that courses through its curricular structure, are failing follow the rapid change that occurs with society in general and in particular the market."

Also according to Oliveira et. al. (2005), currently there is a clear tendency to call Production Engineering "Full" ...) which has a comprehensive curriculum, capable of forming a professional with a holistic and highly prized position in the market today.

For this study checked the menus of all disciplines of the courses chosen by selecting those that have their menus of topics related to sustainability, environment and socio-environmental responsibility, whether they are directly related to the topics or adding a course. With this analysis it became possible to compare the institutions on the hours spent on the teaching of sustainability and the environment.

This information will be useful to examine how the university approaches to sustainability in their disciplines, the professional orientation and applicability of information provided to students, and diagnosis of the situation addressed by each institution, how is the integration of theory and practice of sustainability and environmental responsibility.

2. METHODOLOGY

Data collection consisted of visits to official pages on the Internet, both from INEP (www.inep.gov.br) as of Higher Education Institutions offering the course in Production Engineering and the Brazilian Association of Production Engineering - ABEPRO (www.abepro.org.br) as well as secondary data from other studies that have been developed with the same focus.

The procedures followed the order: first were investigated by the general information site for the INEP, subsequently, through access to official pages of the institutions surveyed, we analyzed each of the different curricular structures (curriculum, syllabuses and curriculum matrices) . A total of fifteen institutions were surveyed and the sample was comprised of five courses, representing each region. Possession of curricular structures and to evaluate how the courses of the different regions are dealing with some issues considered vital and current, due to legal requirements and market developments, we proceeded to measure the courses taking into consideration the following points: a) total course hours, b) distribution of hours of theory and practice, c) total hours in the subjects of sustainability and d) total hours of courses related to sustainability.

3. THE STUDY

3.1 Institutions and scenarios of the courses

To study the presence of the sustainability issue in training programs in production engineering, information was collected from five institutions of higher learning, as follows: In the Northeast the Federal University of Pernambuco (UFPE) based in the city of Recife in Pernambuco state, which was founded in August 1946 through the union of the faculties of Law (1827), Medicine (1927) and Philosophy (1941) with School of Fine Arts (1932) and Engineering (1895), forming the University of Recife, the first university center of northern and northeastern Brazil. The course of production engineering at UFPE was authorized in June 1999 and the first entry in 2000. The course lasts 10 semesters hours and 3,600 hours, with 40 students per entry. For purposes of this study is called IES-northeast.

Among the institutions of the southern region was selected the Universidade Federal de Santa Catarina (UFSC) founded in 1960, headquartered in Florianopolis in Santa Catarina state. It is among the ten best universities in Latin America according to Webometrics Ranking of World Universities. He began acting in industrial engineering in 1969 with the Master's degree in industrial engineering and production management were created in 1979 and undergraduate courses in production engineering of civil, mechanical and electrical. The course is organized into 10 semesters with a schedule of 4500 hours, 40 entering students per year in annual two entries of 20 students. For purposes of this study is called IES-South.

In the southeastern region selected the course at the Federal University of Juiz de Fora (UFJF) which was founded in 1960 in the city of Juiz de Fora in Minas Gerais. The undergraduate program in industrial engineering was established in 2000 and is among the six courses that have obtained maximum concept in the National Examination Performance of Students (ENADE) in 2008. It is the first graduate course in Production Engineering to be certified by ISO 9001:2000 in Brazil. It has a duration of 10 semesters, with the total workload of 3,640 hours and receive 20 students per semester. For purposes of this study is called IES-Southeast.

The Midwest present the information from the Federal University of Goiás (UFG) which was founded in 1960 through the union of existing colleges, with headquarters in the city of Goiania in Goiás state of the undergraduate course in Production Engineering was started in 2008, aiming to train more generalist engineers to the region. The course has face modality with annual intake of 50 students. The course has a duration of 10 semesters, has annual intake of students and a total of the 3,660 hours. For purposes of this study is called IES-West Center.

In the northern region known as the Amazon region used for studies of the University of Pará (UEPA) based in the city of Belem in Para state which had started its operations in 1994 from the amalgamation of the various state public colleges. The undergraduate degree in Production Engineering was established in 1998 and gained recognition in 2003. The university is constantly growing, and received 138 new teachers in 2008. With face modality, the course has minimum of 10 semesters and a total of the 3,600 hours. The course has an annual intake of 70 students, 40 students on the campus of the city of Belem and 30 students on the campus of the city of Redenção (Xingu region) For purposes of this study is called IES-North.

4.2 Presentation and Analysis of the data found

Data reveal that all institutions have reviewed the curriculum of the course of a set of production engineering disciplines with a focus on sustainability and other disciplines related to the topic.

Comparing the ratio of the total course hours and hours devoted to courses focused on sustainability and other related to the topic, according to the theoretical and practical, it appears that only the IES-South dedicated practice workload, as Table 1, prepared by Portilho for this article.

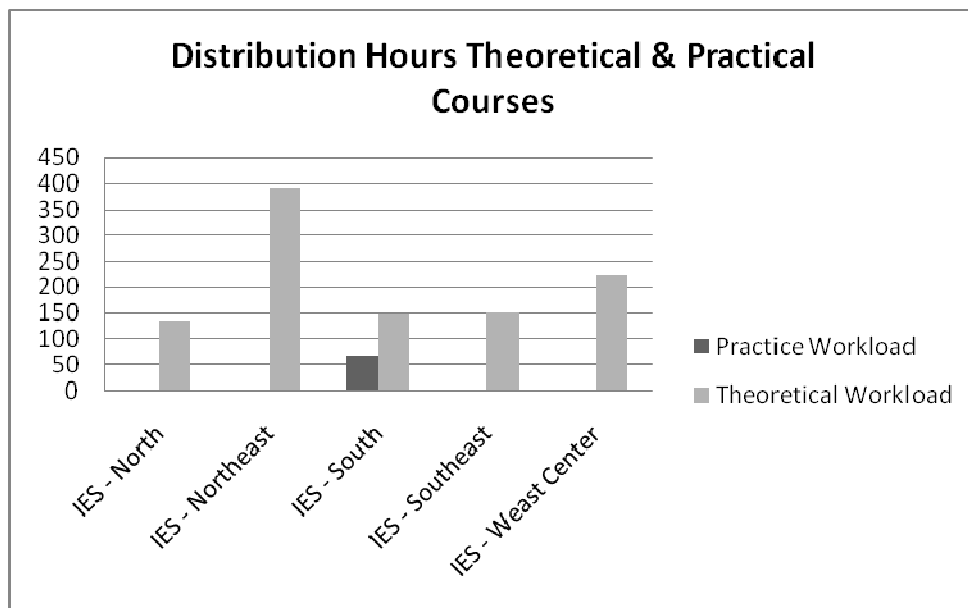


Table 1 - Distribution Hours Theoretical & Practical Courses

The higher education institutions surveyed have a coefficient of percentage between 4% and 11% of subjects relevant to the teaching of sustainability for a total of between 3,600 hours to 4,500 hours, as noted in Figure 1 constructed by Portilho for this article.

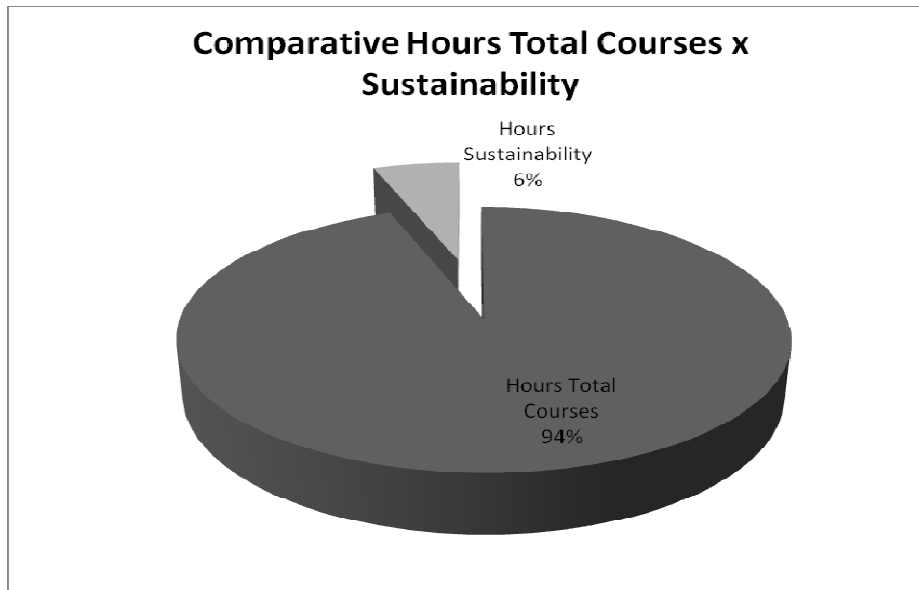


Figure 1 – Comparative Hours Total Courses x Sustainability

Concerning the location of the disciplines within the nuclei of basic content, professional and specific, we found most subjects located in the core content professional and mostly only with theoretical content.

4. CONCLUSION

This is a preliminary study for which he was selected and studied a small sample size, unrepresentative but indicative of other and urgent studies should be conducted on the curriculum of training courses for production engineers, considering that these are the contents that should make them capable of working in management in companies with competitive ability to produce with sustainability.

The data reveal that all the institutions studied devote hours of training to the subject, and the IES-Northeast has a superiority of studies related to the theme of sustainability within their graduation. As for total hours of classroom and practice for the teaching of subjects, it appears that only the IES-South intended hours in their curriculum organization for practical classes, which may reflect favorably on the professional activity of graduates.

About the theoretical and practical training, lack of practical approach to teaching sustainability within the courses Production Engineering, may be aggravating the moment in which we have instances of government and society in constant search for performance improvement over the environmental issues and sustainability.

These preliminary data allow us to conclude that institutions of higher education study, training of production engineers still do not address in his resume, as the key to sustainability and competitive.

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