Model for engineering education to development of competences and abilities

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Abstract - **This work presents a work with groups of students of the Civil Engineering course of the Universidade Estadual de Londrina. Currently there are a great difficulty in the competence and abilities of academic students to face the growth of works in the civil engineer areas. The current job market requires enterprising professionals, with critical thought in function of the consumption of new materials and the environment restrictions. Training workshops have helped to develop these abilities and shown that it is a good alternative. The student's performance improves when they have to identify and to consider solutions for real problems of engineering. This process generates a high performance and a very good professional behavior showing that the students need challenges. The challenges motivate the learning and the results of workshops are very interesting. The work developed was a shipwreck and the beginning of a new life in a desert island. They had been faced aspects of survival, of life in community and activities to develop a sustainable urban accumulation. The final item developed by each team was a board game which was tested and evaluated by each teams.**

Key words: engineering education, competences and abilities, motivation, board game.

INTRODUCTION

The proposal of this work is to develop aspects of the academic formation not satisfactorily contemplated throughout the graduation course. It is verified the necessity of a better approach between the academic activities and the activities related to the professional exercise in the field of civil engineering. The experience, which the students eventually have with the situations of practical characteristic of the exercises of the practical professional, shows some of their interest in relation to these activities. During the graduation course these experiences are almost always restricted to visits to stonemasons. Some graduation courses adopt the development of practical activities character in the form of curricular period training, and some also stimulate the development of extra-curricular period training. Even so, the students have certain deficiency in the development of some abilities that require a more efficient treatment on the part of the tutors or the professional who orientates them during the training period. Because of the accelerated rhythm in the stonemason, it's neither possible to detect the personal lacks, the progress and improvement that each students presents, nor to check the development of abilities and competences, such as the initiative, the capacity to identify problems, the creativity, the dynamism and the critical thought (1).

GENERAL CONSIDERATIONS

Now a days, the entrepreneurs of the civil construction demand more egress abilities and competences, considered they are basic importance for the satisfactory development of the functions of the civil engineer (2). It has been a long time since civil engineer developed these abilities throughout the professional exercise. However, one of the functions of the university is to promote and to motivate the appearance of new ideas and critical thought. And it's also a responsibility of the university to develop the capacity of team work, to provide conditions to become adapted to unusual situations, to favor the development of particular abilities and competences in accordance with the personal aptitudes of each one, to promote the interest in professional practice and to favor the increase of the proper rhythm of the student (3). On the other hand, it is necessary to intensify the humanistic formation of the professional of civil engineering so he grows as a person and a citizen (4). The stimulation of a citizenship conscience and the professional ethics are other factors that favor the global formation of the student. This didactic-pedagogical study offers conditions to the development of the maturity and complements the moral formation of the human being. In parallel, it is possible to stimulate activities toward the teaching career and research (5) and still give subsidies to the student so he can improve his capacity to administer his academic life. The student extends his capacity of leadership and takes conscience of the process in which he is. It also makes possible to discover and to intensify his capacity of

leadership, of taking decisions and helping to develop the critical thought based on ethical and cultural scientific standards. The development of the creativity and the exploratory character are others aspects studied in this work through practice to identify and to delimit problems, to define objectives and goals, to adopt adequate methodologies of work and, finally, to develop the lecture habit for the improvement of the verbal and written communication (6). In order to reach these objectives, it is proposal activities of identification and development of inherent personal and collective abilities to the professional exercise of civil engineering. Different forms of communication and oral and written expression are worked, involving the interdisciplinary and the globalization (7). Daily aspects of the civil workplace are observed through the theoretic problems, aiming to take decision through an individual and collective methodology of work of (8). Finally, the students are motivated to work real situations based on the rationalization of tasks. Another aspect considered in this study is the development of the enterprising and humanist character of the professional (9).

Objectives. Instigate the development of necessary abilities and competences of a good professional performance of civil engineers. The specific objectives are:

- ♦ Develop new ideas to break paradigms and to develop the critical thought;
- ♦ Grow the capacity of team work;
- ♦ Prepare the adaptability conditions to unusual situations;
- ♦ Intensify the humanistic formation, the professional ethics and the citizenship conscience;
- ♦ Develop the leadership and the capacity of taking decisions;
- ♦ Develop the critical and practical thought to identify and delimit problems;
- ♦ Motive the creativity development and the explorative character;
- ♦ Stimulate the practice of defining objectives and goals;
- ♦ Stimulate individual and collective work;
- ♦ Improve verbal and written communication.

METHODOLOGY

Development. The work methodology involves the accomplishment of workshops in which are used dynamic of group and games. The goal of these workshops is to develop practical activities and to work similar situations to the real ones providing the students the necessary knowledge. The students work in teams and participate of activities of discussion panels and debates. The completed activities are shared by the groups in the form of panel presentations and execution. The main ideas of the study are worked by each team and developed by games. To finish the cycle of each activity, practical sessions with auto-evaluation, individual and collective evaluation are carried through.

Evaluation. The evaluation of the activities is made through the attribution of points for each task, given by the professor and by the participants. Each student and team is evaluated. The final punctuation of each participant involves the personal performance and the performance of his team. The objective is to work individual participation in relation to the group and aspects to the individual and collective responsibility. In the same way that the progress and the personal persistence collaborate to increase the punctuation of the team, the recklessness and the lack of persistence can diminish the score of the group. This methodology makes each element engaged with the group, as well as establishes a certain exigency of each element in relation to the works to be developed.

Program of activities. The program of the work is presented through various activities as described below:

Socialization and Formation of the teams: Initially an evaluation exercise of the predominant trend of the individual behavior is carried through, with the posterior division of the participants in two groups: a group of the predominantly rational participants and another with the intuitive ones. This division is made through the elaborated evaluation of 50 questions, aiming to verify the predominance of the rational or intuitive character of each student. Later, the teams, composed by 50% of elements which were considered predominantly rational and 50% of elements which have intuitive behavior will be formed. This dynamics aims to form diversified groups.

Challenge: To become a concrete exercise, a fictional ship trip is proposal to the participants. After sailing for some days, a shipwreck happens and the survivors will have to occupy five life-boats and take some supplies. As each life-boat holds only twenty passengers, some survivors can't be safe. In turn, the survivors will have to choose only twenty of the many boxes of supplies that remained in the ship to take on life-boats.

Identification of Abilities and Competences: In this stage the identification of the necessary aptitudes to be developed is the capacity to analyze, to judge issues and to consider solutions to be used. Each team will choose the elements to be safe, so they survival in the closest archipelago. This activity proposes to the participants to evaluate the necessary abilities and competences for the survival in a desert island.

Identification of Necessities and Priorities: This activity makes the participants search the objectivity and rationality of the supplies which are really necessary.

The main idea is to put the participants in confrontation with his personal necessities and the common weal.

Identification and Solution of Problems: When disembarking in their respective island each team will find a series of obstacles to be faced, as the presence of rocks, quicksand, wild beasts, lack of water and others. Each new situation demands a group strategy to identify the problems and to find solutions. It is necessary that they indicate a leader among the survivors to lead each operation in function of the personal abilities. The exercise practice the collective democracy which makes the group face problems of discords and divisions that must be confronted.

Rationalization and Creativity in Team: This activity involves the construction of a necessary structure for the survival in an island and the objective is to motivate the development of group work. The participants will have to work jointly in the execution of a rigorously script. The materials will be given. The best solution is to use less amount of material in a shorter period of time.

Sustainability and environment preservation: The team will have to complete the activity creating a board game. The base of the game is the urbanization of the island creating a new urban model. The island will be divided in allotment that will be distributed to the survivors. Ambient degradation will not be able to occur and natural resources will have to be rationally used. Men interventions don't have to foresee replacements and renewals to preserve the natural resources and the quality of life. They will constitute strategists, ethical norms, rules of order and justice, devices of defense, rules of health, alternatives of leisure, procedures of cleanness and welfare, destination of residues, habitation alternatives and urban services. The urban nucleus will be sustainable and will be able to use the natural potential and if they will create ecosystem and biodiversity preservation norms.

CONCLUSIONS

These challenges motivate the learning and the results of workshops are very interesting. The students had faced aspects of survival, of life in community and activities for the construction of a sustainable urban accumulation. Each board game was tested and evaluated by each teams. Some aspects had been worked, among other things, adaptability, survival, break of paradigms, co-responsibility, evaluation of abilities, management of human resources, dynamics of group, personal evaluation, communication and enterprising profile. The activities developed the systemic organizational vision, it also motivated the identification of collective solutions and worked the optimization of resources. One of the important points was the adequacy to the rules and conditions established.

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