ACTIVE LEARNING AND AUTONOMOUS LEARNING.

AN EDUCATIONAL EXPERIENCE

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Abstract

The obtained experience in the active and the autonomous learning tasks execution in the teaching of the subject: Reinforced Concrete Structures and Devices Construction, of the career of Technical Architecture by the Universidad Politécnica de Cataluña (Politechnical University of Catalonia, UPC), is presented. This article gives continuity to the work performed in the scene of educational improvement developed in Barcelona, and framed inside the European Higher Education Area [1, 2, 3, 4, 5]. It intends, therefore, to contribute with the current descriptive tendency in the learning condition applied in this subject.

The examples presented include analysis of inside-classroom group activities co-directed by the professor, autonomous activities outside the classroom, works by means of using simple programs with applications, and open forums for discussion among the students with dialectical purposes. All the previous aspects have the objective to achieve the knowledge. The educational results obtained are consider as acceptance indications of these techniques and the satisfaction level reached by part of the students, because the techniques establishment are continually presented and analyzed. Examples of these conclusions are the official surveys, the not official surveys, the Indices of Educational Efficiency (IEE) and the Indices of Educational Success (IES). All the indications observed have conducted to deduce that the learning process require previous preparation, time dedication by the professor and programming of activities.

Workshop Topics

Active learning; Autonomous learning; Educational evaluation; European higher education area; University education.

I INTRODUCTION

Nowadays the European educational context is being induced by a modification or an adaptation process in the teaching of the knowledge, relocating it from the up to now unique educational process, focused on traditional classes and the professor as the origin of the knowledge, to a complete form centered in know-how the acquisition process in the student is developed. This change in the college educational procedure has been accompanied by the use of new communication technologies, such as the virtual campus, the on-line studies, the internet, etc. [6, 7, 8, 9]. On the other hand, in the design processes of a subject, in all the current curricula contents, professors should be conscious that students are now spending more time and cognitive capacity in the acquisition of know-how, edition and exchange of the know-how by the use and application of electronic media [10, 11] which are currently imposing their versatility, availability, simplicity and easy-to-reach.

Therefore, the recent demands for the university professors involve acquiring new dexterities or data processing abilities that satisfy the new teaching philosophy. Examples of them are: a) to be a facilitator of the pedagogical resources of the knowledge, b) to be a designer of the learning contents, using the Information and Communication Technique (ICT), c) to be able to produce educational material in several formats (visual, auditory and of direct participatory experimentation), d) to systematize the evaluation with the aid of innovative procedures (continuous evaluation, automatic computerized evaluation, etc.), etc. Accordingly, the acquisition of these educational skills would allow the correct adaptation of the formative technical realities that are being implemented.

II DESIGN OF THE VIRTUAL CAMPUS

The design quality of a course with the application of a Virtual Campus, the use of appropriate techniques or mechanisms, and the context in which the learning is performed, are the decisive factors that have an effect on the success or on the failure in the current university education context, in the learning in general and in the acquisition of significant knowledge. At the present, the application of new tools, as the use of the Web, the data processing networks and the software and hardware devices, have become an inescapable educational need. In the educational area, the data processing market has now two types of applications for a Virtual Campus creation [12]:

1. Virtual Learning Environmental (VLE): Learning of the students centered with management tools and contents supply.
2. Managed Learning Environmental (MLE): Data processing system that includes the general benefits of a registration, management of courses,

academic expedient, maintenance tools, exchange and publication of contents, and finally, the facility to create personalized and educational progresses reports in virtual time.

In the UPC, it has been implemented the data processing system Moodle, renamed here as "Campus Virtual Atenea" (Atenea Virtual Campus), adjusted to the characteristics of the previous described system MLE. The individual characteristics of the "Campus Virtual Atenea" and their application inside the subject studied in this work have been published and are available in the Web for their consultation [2, 4, 5]. Nevertheless, it is necessary to emphasize that in this Virtual Campus design, the ideologies for the creation of the learning contexts have been followed, allowing a creative teaching [13, 14]. In a simplified form the ideologies, including examples that are in the Virtual Campus of the subject, are:

1. Connection and diversity: The connection among the same-subject students should be facilitated, permitting that with the diversity of the information of each member, the knowledge be enriched (forums, chats and e-mail).
2. Shared and divided invention/creation: The connection among all the members of the group should be caused; since the subdivision of the work is required in order to obtain common objectives in the final result of the process (work in group and puzzle technique).
3. To lead and to collaborate: Work spaces where the members share collective responsibilities should be promoted (to define participation allocations and to grade some of the activities executed by the collective work).
4. To improve limitations and to eliminate inhibiting: The work and the performance optimization have to be promoted (definition of indications with gradual evaluations and anticipated plan of all the educational and evaluation process).
5. Good expectations and errors acceptation: High expectations must be transmitted to the student and the located errors have to be commented in a positive form (correct direction and support by a student-professor feedback).

It has been verified that the quantity of information which a student retains, varies in function of the type of activity performed to obtain it. In this way, a student could be able to retain the 10% of the information that he or she reads, the 26% of the information that he or she listens to, the 30% of the information that he or she observes, the 50% of the information that he or she observes and listens to, the 70% of the information that he or she comments or speaks and the 90% of the information that he or she comments and works with [15,16]. In order to reach a greater student performance, as the previous comments show, it is necessary to do more labor than just listening to the professor; so the student has to practice in a persistent form the active learning and the autonomous learning, both cases based on the principles of the constructivism (significant form of learning).

II.1 Active Learning

The preparation and the pedagogical improvement have to be established with the aid of active learning works. This learning has to be developed in a structured form and according to the constructivism postulate [17, 18, 19]. Examples of active learning techniques (learning focus on the student) are: the forum of discussion, working in group or in pairs, the play of hierarchies, the learning with equal range members, the creation of posters, real case studies, etc.

Additionally, the use of Virtual Campus can also be an opportunity for the students to expose their experiences and to promote their creativity [20]. In our experience, the use of the forum of discussion tool has been implemented. The basic characteristics facilitated by the data processing platform, utilized in this dialogue tool, are the following:

1. Identification: The users are identifiable in all contributions.
2. Multidirectional: All the students in a classroom have access and dialogue among them.
3. Benefits: To include files, images or links to the Web, besides including text in the dialogue, is admitted by the system.
4. Connection: Direct answers to a single user, open answers to the whole group, checking the dialogues and notification by email of new annexations, all are permitted by the debates.

A small part of the subject final grade was obtained by those students who have a minimum number of contributions in the forum of discussion, in order to motivate the use of this tool. The registered students contributions till February 6th 2009, for the different available activities in the Virtual Campus of the subject, reflects that the forum of discussion has reached the maximum number of visits, contributions and consultations done in the analyzed course (Group 4T), reporting the following significant data:

1. The number of consultations of the available material in the Virtual Campus was 36499 (from September 9th 2008 to February 2nd 2009). The number of students participating in the subject was 68, so a student has taken part in the Virtual Campus, an average of 537 times.
2. The most visited educational tool, and therefore the better valued with index of utility, has been the forum of discussion inside the classroom; 9867 visits, representing an average of 145 registrations by each student.
3. In the 9867 visits of the forum, 9286 of them correspond to visit registrations (reading of the dialogues), representing 137 readings by each student.
4. In the 9867 visits of the forum, 528 of them correspond to discussion themes registrations as contributions (proposed of dialogue), representing eight themes by each student.

The correct use and operation of the dialogue forum is confirmed by the previous data. As an example of this, Figure 1 shows how the students obtain by themselves the knowledge with the initial consultation that is completed by one of them.

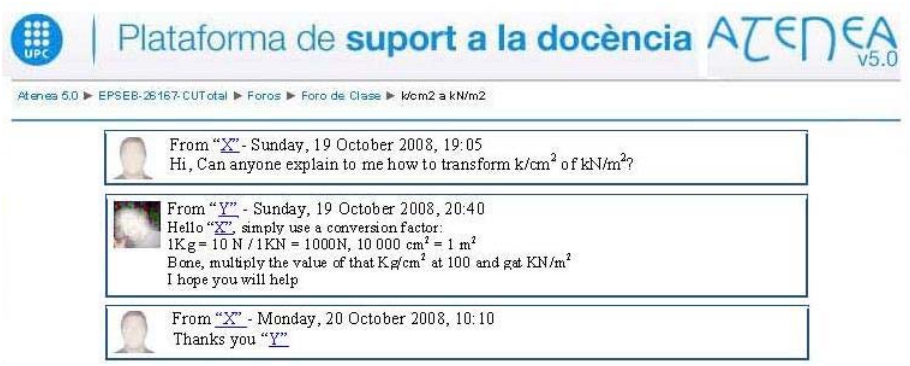

Figure 1 Dialogue inside the forum that promotes the connection.

The work in groups inside the classroom is another technique that offers results and that are according to the active learning philosophy. In our case, it has been implemented trying "to say the knowledge in words", with the dialogue among the work teams members. The established steps for this activity have been defined in a schematic form, as the following points:

1. In a previous procedure, the different documents with the contents to develop in class and the work team members are defined in the Virtual Campus, notifying by email to the members of each one team.
2. Inside the classroom the teams are arranged in circles, in order to promote the direct dialogue, and the material is subdivided, in order to each member works by himself or herself part of the information.
3. Each person explains to his or her team the most important points in his or her part of the work; an all-directions dialogue that fortifies and gives importance to the knowledge is established.
4. A work team is selected randomly to explain to the whole class the general consensus achieved in its analyzed information; meanwhile the others students participate asking questions or doing emphasis in points that they consider important.

In Figure 2, different moments during this activity execution are presented; the dialogue and the active discussion among students and between them and the professor, is shown.

The previous active learning technique has a high acceptance in the students; since the personal contact, the analysis of the knowledge and the common work, accrediting it as an ideal tool.

II.2 Autonomous Learning

The autonomous learning techniques usually called as SDL (Self Directed Learning) are based on the concept that, in the learning process, the ones who are able to make significant and logical decisions of it, are the individuals [21]. The autonomous

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Figure 2 Active learning, the work in groups inside the classroom.

Among the diverse autonomous learning application techniques, the learning based on the PBL technique (Problem Based Learning) could be considered as the one with better results achieved; it maintains the student motivation, increases the student development of the theoretical knowledge and acquires the student desirable abilities. The basic operational points of the PBL technique, based on the RPO Model (Responsibility Personal Orientation) [23, 24, 25] are:

1. The student will act as a sensible person: To achieve the objectives, he or she makes decisions in an autonomous way (internal process of the student).
2. An orientation process exists: Method and instructions guide the student in his or her work (external process contributed by the professor).

The two previous processes have correlation between them, and they are influenced by the social context in which they are applied, using this context to increase or to decrease the obtained results. The experience applied in class is ascertained in this work only in the referring to the second aspect (orientation process). For this, the steps applied in the definition of an autonomous learning activity using the data processing tool (spreadsheet to determine the anchorage length of steel bars) were:

1. Complexity in the use of the tool: The use of the tool needs to be simple, avoiding loss of attention and stimulating the objectives. For example, a spreadsheet with simple instructions, predefined initial information and errors prevention by protection the cells.
2. Previous knowledge: The possibility to obtain high levels of knowledge depends on the starting point. For example, the contribution of a solved exercise.
3. Acceptable expectation: The dexterity with a problem is faced is function of the feasibility of the proposed challenge and the challenge proportion

with its knowledge. For example, progressive challenges are specified by two levels of knowledge:

a. Basic or mechanical: Manuel solution of the problem and verification with a spreadsheet.
b. Upper or deductive: Establishing correlation among variables using the results deduction and analysis with the spreadsheet.

In Figure 3, the spreadsheet used for the autonomous learning activity is presented; the information cell and the selection of predefined variables cells are in red color. Selecting the variables, the calculation of the value l_b (anchorage length of a steel bar) can be verified as correct.

In a second level of knowledge, utilizing different combinations of the established variables, it is possible to deduce and to reason correlation among them.

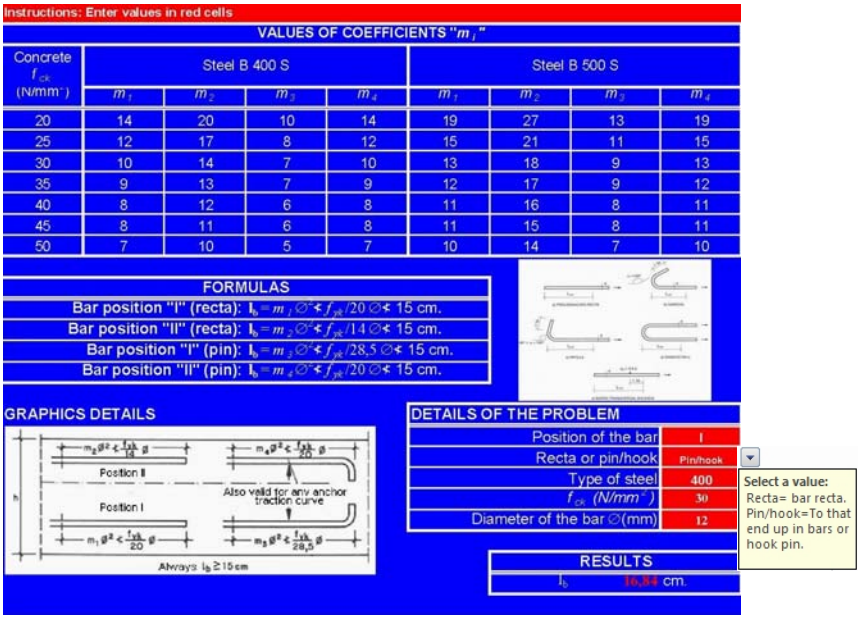

Figure 3 Spreadsheet used to determine relation among variables in the steel bars anchorage length calculation.

III RESULTS

As signals of the adaptation and their establishment of the correct active learning and autonomous learning tasks, a series of historic data of different evaluation procedures in educational quality, obtained in different courses in the time (for the particular subject and professor in this study), are presented.

The results obtained from the official educational quality survey by the UPC are presented in Figure 4 [26]. The four studied variables show an adequate increment with the time, achieving the maximum levels in the last evaluation. Thus, the evaluations obtained by the students in different educational parameters defined in

the survey SEEQ [1] are shown in Figure 5, the establishment success of these innovative experiences is appreciable. Finally, the educational quality parameters defined by the UPC as indicators of success and efficiency in the teaching, are shown in Figure 6, in this last figure, the number of registered students for the subject in each period and the professor is presented.

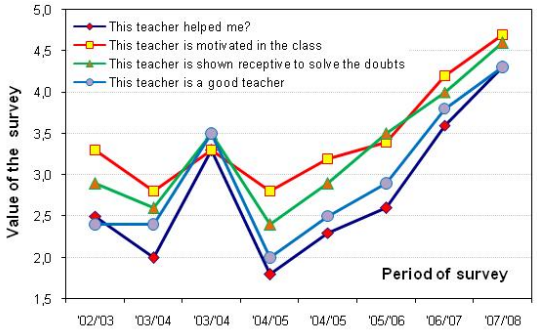

Figure 4 UPC official survey [26]

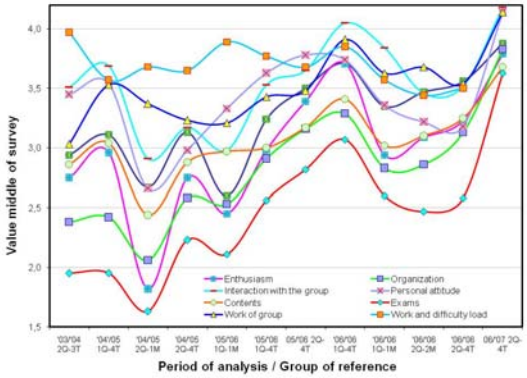

Figure 5 SEEQ surveys [1]

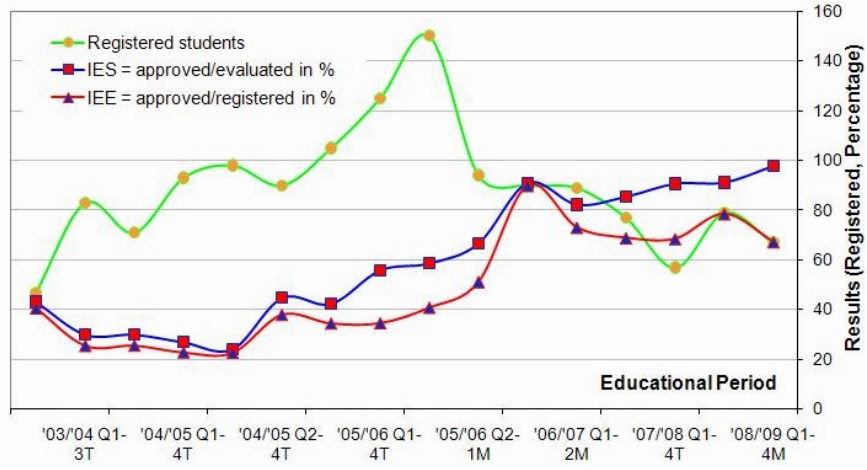

Figure 6 Index of Educational Quality and Index of Teaching Success.

IV CONCLUSIONS

The development and generation of the tasks to employ in the active learning and the autonomous learning require work, dedication and previous design by the professor who utilizes them. Even so, the students are more enthusiastic to acquire the knowledge when these techniques are used. The satisfaction levels in the students, in the educational quality area, are increased in all the control parameters analyzed, taking for granted these techniques adequate utilization.

The number of students who finish the course with success and the educational efficiency achieved by the implementation of these activities are feasible to be increased in a progressive form; without affecting the quantity and the educational quality required for the subject. The Virtual Campus accomplishment has allowed to add and to support the tasks of the active learning and the autonomous learning; this is an adequate and necessary alternative in the current times college teaching.

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