

## The Virtual Campus – A Collaborative System

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*This paper defines the concept of virtual campus as a collaborative system. It builds architecture for virtual campus oriented on collaborative training processes. Are established the quality characteristics of the collaborative instruction process and them is associated a metric for measuring the performance level. The construction validation is done on measurements made in the virtual campus of a university of economic studies. Here is presented the level of research in the area of collaborative systems oriented on learning processes. Are determined the influence factors of quality characteristics and is shown a way to analyze the correlation between characteristics. Is compared the processes effectiveness of collaborative training with classical training.*

**Keywords:** virtual campus, collaborative system, collaborative learning, metrics quality, architecture

### 1 The virtual campus

A virtual campus means any portal or website designed to address a community study, providing its resources and teaching functions of communication and collaboration appropriate. Some of these websites use graphics elements representing a physical campus, with café, library, class. A virtual campus refers to the online offerings of a college or university where university work is completed either partially or wholly online, often with the assistance of the professor or teaching assistant. [1]

In the virtual campus you will find the elements necessary for an effective collaboration between the agents which interact in this learning community.

The virtual campus represent a collaborative system which offer learning activities, rather than simply provide information. The virtual campus paradigm is designed as a move away from information websites towards learning websites, from providing multimedia documents towards involving the user in learning activities. [2]

The collaborative systems are classified in many categories after the criteria field of application. The virtual campus it is included in the category of collaborative learning systems and, also in the category of collaborative educational systems.

A virtual campus is an environment of online learning based on the client server concept and Internet technologies. It gathers the tools and the resources necessary to the support of the various agents playing a role in the collaborative learning system. [3]

The cooperation and collaboration facilitate and encourage learning and social interaction among distance learning students in a virtual learning environment, which can be designed like a collaborative system. [4]

In [5], Crabtree define collaborative systems like interactive systems. Collaborative work can be successful if all members show goodwill and responsibility. Collaboration in a virtual campus is necessary to deal with such large projects. The collaborative and essentially social character of work need to be appreciated in undertaking the design of interactive systems.

Virtual campuses are already a reality with the advances in e-learning and web technologies, distributed and collaborative systems and broadband communication, as well as the emerging necessities of distanced universities for collaboration on offering common programs. [6]

The virtual campus is a place on the internet where students can go to take courses, meet with academic staff, and communicate with other students. The development of the

virtual campus has been influenced by research in design science and is based on the conceptual metaphor of architectural design. [7]

In [8] the virtual campus is considered as a kind of social interface. Besides the main needs of communication and collaboration, the virtual campus should enable the students' identification with the virtual university like a real campus does in reality. The realization of virtual campus has to overcome anonymity and has to create a sense of community and solidarity.

## 2 Collaborative learning in virtual campuses

Collaborative learning is a relationship between learners that needs positive interdependence, individual accountability, interpersonal skills and reflecting on how well the team is functioning and how to function even better. [9]

This form of teaching has a lot of names and there are some distinctions among these: cooperative learning, collaborative learning and work teams. Regarding collaborative learning, there are three general types of team work: informal learning teams, formal learning teams and study teams.

*Informal learning teams* are temporary clusterings of students within a single class session. Informal learning teams can be initiated, for example, by asking students to turn to a neighbor and spend two minutes discussing a asked question. Also, teams can be formed of three to five to solve a problem or pose a question. Informal teams can be organized at any time in a class of any size to check on students' understanding of the material, to give students an opportunity to apply what they are learning.

*Formal learning teams* are established to complete a specific task, such as perform a lab experiment, write a report, carry out a project, or prepare a position paper. These teams may complete their work in a single class session or over several days. Typically, students work together until the task is complete, and their project is graded.

*Study teams* are long-term groups with stable

membership whose main responsibility is to provide members with support, encouragement, and assistance in completing course requirements and assignments. Study teams also inform their members about lectures and assignments when somebody has missed a course. The study teams are more valuable if the class is larger and the subject is more complex. [10]

In [11] is presented the concept of cyber-learning on the virtual campus. The virtual campus is seen as a place for research on crowd simulation and shared cyberspaces. Its content changes frequently.

The virtual campus is a collaborative virtual environment, which is computer-enabled, distributed virtual space or a place in which people can meet and interact with others, with agents and with virtual objects. The collaborative virtual environments vary greatly in their representational richness from 3D virtual reality to 2D and even text based environments. Collaborative virtual environments clearly have the potential to enable innovative and effective distance teaching techniques, involving for example debate, simulation, role play, discussion groups, brainstorming, and project-based group work. The emphasis can be placed on the human-to-human interactions as common understandings are negotiated and developed across differences of knowledge, skills and attitudes. [12]

The concept of collaborative learning, the grouping and pairing of learners for the purpose of achieving a learning goal, has been widely researched and advocated. The term collaborative learning refers to an instruction method in which learners at various performance levels work together in small groups toward a common goal. The learners are responsible for one another's learning as well as their own. Thus, the success of one learner helps other students to be successful. [9]

A student can be beneficiary of collaborative learning only if he participates in supportive learning teams. For this reason, the main research interest is to aid and provide the means for the configuration of learning teams

that are adequate for different learning situations. A key issue in this process is to make the educational function and structure of collaborative learning groups clear, by identifying and making explicit both the individual and group learning and social goals, as well as the relationships, interaction processes and roles that determine the nature and the manner of the group. [13]

### 3 Virtual campus architecture oriented on collaborative learning

The architecture of a virtual campus that would support the development of a learning community should be based on the pedagogical requirements of the community. Since the core activity of constructivist learning is collaborative interaction, localized sites that support this activity must be central to the overall system environment. Other peripheral locations should also be used to support the social and academic needs of this critical activity. [12]

The implementation of the virtual campus architecture is a long term aspiration, requesting the solution of many research problems, both in the educational and the technological fields.

The development of the virtual campus has been influenced by research in design science and is based on the concept of architectural design of the virtual campus, which is considered at three levels: the realization level, the representation level and the interface level. Identifying these levels provides a basis for the design of virtual worlds for professional and educational environments. The consideration of the representation level means that a person in the virtual campus can make use of the facilities in an intuitive manner. [14]

Collaborative virtual environments have lately been used for learning in different situations, and offer promising possibilities for supporting social conscience. [15]

The virtual campus is a virtual organizational structure of collaborative type in which interacts five target groups:

- the *target group of students*, composed by participants in tele-activities of

training, testing, elaboration of homework, documentation, participation in online meetings, forums communication, banking transactions for study fees payment;

- the *target group of teachers* who complete multimedia teaching materials for virtual campus training, evaluates papers submitted online by students, update databases proper evaluations;
- the *target group of people outside* the virtual campus, which informs about the performance on campus, interact conveying information allowing the selection of students;
- the *target group of organizations* which demands for workforce specialists, requiring new training courses;
- the *target group of campus management*, which defines development strategies, moderate discussions on forums, study the labor market, select teachers for the courses who will take place, establishes specific program costs [16].

In the virtual campus should take into account the stringent elements of scheduling, namely those periods in which each resource is available. A course is posted on the platform in a given period of time. Before and after this period of time, the course is not available. Also, the upload of homework and projects undertaken by students is done before a certain date and hour. The projects uploaded on the platform after the deadline are not taken into consideration.

An important role play the security features, namely the possibility of accessing user accounts or email addresses by unauthorized persons. The platform corresponding to the virtual campus must support simultaneous access of a huge number of visitors. The database containing the user authentication data, their contact data and the results of assessments should not be accessed by other persons than those authorized.

The agents of virtual campus represent any entity interacting or exchanging data in the collaborative system, be they people or software applications. In the act of collaborative learning, are distinguished five

agents categories: a *learner agent* who wants data to convert it into knowledge, an *data provider*, and three facilitators in the data conversion process, such as a *designer* who makes data easy to absorb, a *trainer* who assists the learner in the conversion process, and a *manager* who provides an easy context to the process.

Every agent's roles can be seen as a group of processes that an agent can execute. Each process is a set of actions that a user can perform while interacting within the virtual campus. A process is one of the ways to use the collaborative system. The whole set of available processes define what the collaborative system is used for and demand a specific configuration. [17]

The actors of virtual campus represent everything that interact and exchange information in the system: persons, pieces of software or documents. Some are information transmitters while other are receivers. Most are sometime transmitters, sometimes receivers. Each of an actor's role can be seen as a group of processes or utilization cases that an actor can execute. Each process is a set of actions or operations that a user can perform while interacting within the virtual campus. A process is one of the ways to use the system. The set of all processes define what the system is used for, why it is developed, what are the different ways to use the system. [18]

#### 4 Quality characteristics of collaborative learning systems

The collaborative systems need new educational standards. Collaborative learning system represent a process that helps students become members of knowledge communities whose common property is different from the common property of the knowledge communities they already belong to.

The *anywhere-anytime* characteristic and its potential to support interactive group learning have convinced many teachers to believe collaborative learning environments to be the promising next generation of educational tools for remote education.

The *sociability* of a collaborative learning

system is the extent the collaborative learning environment is able to give rise to such a social space.

Social supplies in collaborative learning systems need to be based upon the concept of *tele-proximity*. Tele-proximity is a term used to show that proximity is brought to a group of people via telecommunication systems and computer networks. [19]

The system *reliability* is determined by analyzing the number of problems solved by the system and the total number of specified problems. Reliability assumes permanent operation of the collaborative learning system, knowledge presented in the courses to be topical and, at the same entry, the system have the same behavior.

A collaborative learning system is defined through some form of construction like:

$\langle \alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7 \rangle$ , where:

$\alpha_1$  – activity,  $\alpha_2$  – location,  $\alpha_3$  – resources,  $\alpha_4$  – people,  $\alpha_5$  – energy resources,  $\alpha_6$  – procedures,  $\alpha_7$  – flows.

Starting from such a construction, the collaborative learning system *stability* is defined as a relationship between the elements  $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7$ . [20]

Another quality characteristic of collaborative learning systems is the *automation*. Many of the processes are developed without human intervention. For example, it automates the measurement of the quality of tests in relation to the way in which the students responded. If the answer of tests developer to a question is a) and 100% of students give answer d), then it will analyze the cause.

Increasing the quality of the educational process and of the virtual campus, designed as a collaborative system, is achieved through *diversification*. This means that the assessment methods should not be the same for all courses. Are supported not only tests with multiple choice, but also are solved certain problems. For example, is given an equation of second degree, the student solves it, submit the solutions and, if these are correct, he gets points. Another example of

diversification of assessment methods is that in which is given a problem to the student, he solve it, enter the results on the platform, the system displays an option to resolve it and if its results are invalid, then it learns how was correct to do. Diversification is achieved also through the use of smart books, in which the student is tested before and, depending on the points that he get, it provides more complex or simple material.

The most telling difference between learning in the traditional and virtual modes is the kind and extent of interaction. In the traditional classroom, the potential for learner-instructor and learner-learner is very high, but instructors have largely ignored this mandate for change and continue to employ the lecture mode as the predominant method of instruction. In the virtual classroom, on the other hand, technology supports collaborative learning, heterogeneous groupings, problem-solving and higher order thinking skills--educational processes that a lecture format cannot facilitate. [21]

## 5 The virtual campus of Bucharest Academy of Economic Studies

Nowadays most people mean by the phrase virtual university a university which carries out much of its teaching, perhaps all of it, at a distance from the learner. The phrase virtual campus is often applied to a single university which has a virtual university fringe round a physical campus, but there are some totally virtual campuses, such as the Bucharest Academy of Economic Studies [22].

The virtual campus of Bucharest Academy of Economic Studies contains three departments:

- the Public Relations and Online Education Service;
- the Internet Service and Digital Library;
- the TV Studio Service.

Each service is headed by a chief of service which is subordinated to the department manager. The virtual campus department ensures the development of virtual education services and research. Also are performed virtual campus logistics and the general coordination of open distance education.

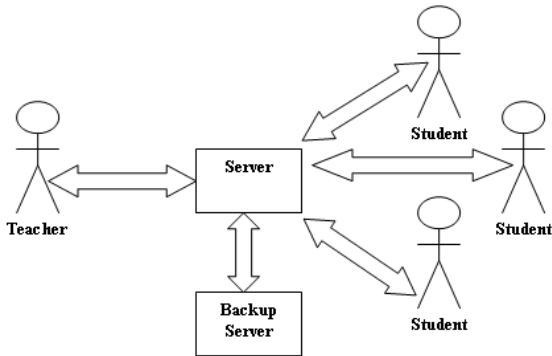
**Fig. 1.** The e-learning portal from Bucharest Academy of Economic Studies

The e-learning platform of virtual campus allows the simultaneous conducting of several online masters' programs. For every education program there is a database of courses and a database of users. The student access to a particular course is based on key authentication. In the virtual campus of

Bucharest Academy of Economic Studies is done online meetings, are posted messages on forums and are discussed issues related to the courses and not only.

The interface of the platform, that supports the works from the virtual campus, is very natural and user friendly. The interface of the

e-learning portal of Bucharest Academy of Economic Studies is shown in figure 1. The virtual campus architecture of Bucharest Academy of Economic Studies is presented in the figure 2:



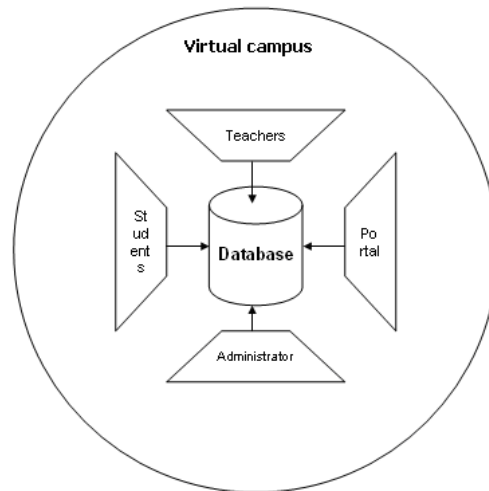
**Fig. 2.** The virtual campus architecture from Bucharest Academy of Economic Studies [23]

The virtual campus components of Bucharest Academy of Economic Studies are designed in the figure 3.

Virtual campus schemes would offer educational opportunities that are no longer location dependent and allow for collaboration with foreign students and teachers and thus promote intercultural understanding [22].

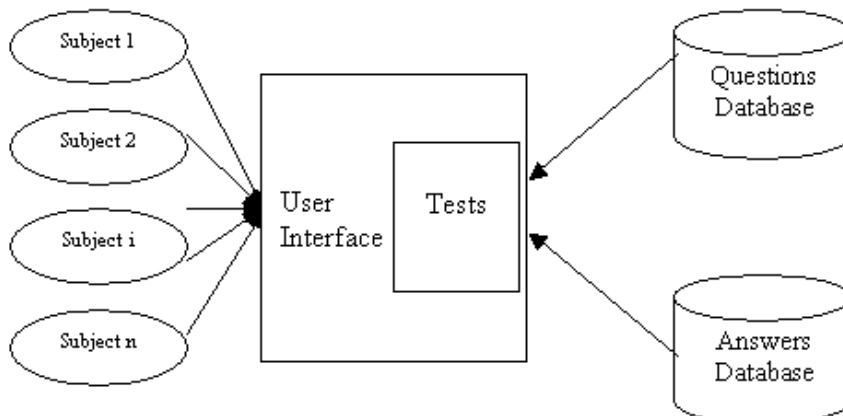
The communication between real and virtual environments creates several possibilities of services to be used in the context of a virtual campus. One of these possibilities is the remote supervision of administrative resources that exist in the institution. This brings more flexibility to staff and can offer more speed in the solution of problems. As example, employees can, through the virtual

environment, remotely turn off electronic devices that are not in use. Components of a real environment can be manipulated through remote commands getting an interconnection between a real environment and a computer application. [24]



**Fig. 3.** The virtual campus components from Bucharest Academy of Economic Studies [16]

A virtual campus is a collaborative educational system serving to develop processes in which teachers post lessons and courses, realize databases of tests, organize the schedule of evaluations. In a virtual campus, a student signs up for certain courses, take exams and receive notes. The structure of an on-line testing application from the virtual campus, used for the evaluation of students' knowledge, is shown in the figure 4.



**Fig. 4.** The structure of the on-line testing application

The subjects answers for the tests questions can be centralized into a structure like in table 1.

**Table 1:** Association between the subjects' answers and the questions

	Question 1	Question 2	.....	Question j	.....	Question m
Subject 1				.		
Subject 2				.		
.....				.		
Subject i	.....	.....	.....	$\beta_{ij}$		
.....						
Subject n						

For any question in the test, the possible answers are a), b), c), d) or e). If the tests are right formulated, the results of the subjects evaluation has a normal distribution: 10% results are between 9 points and 10 points, 10% are between 3 and 4, and 80% results are between 5 and 9.

In this case, for a question in the test the followings situations are possible:

- all the subjects have submitted the answer a) and the correct answer was b); the conclusion is that the question was very difficult;
- all the subjects have submitted the answer b) and the correct answer is b); in this situation, the question was very simple.

In order to measure the performance level of one subject will be chosen a base question from the test and will be calculated the following indicator:

$$PL = \frac{\sum_{i=1}^n p_i}{n}, \text{ where:}$$

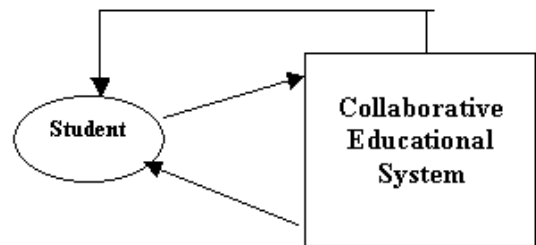
*PL* – the performance level of one subject from the collectivity which participate to the test;

*p<sub>i</sub>* – the points received by the subject *i* if he give the correct answer to the base question (*p<sub>i</sub>* = 10 if the subject *i* responded correctly and *p<sub>i</sub>* = 0 if the subject *i* has given an incorrect answer);

*n* – the total number of subjects from the collectivity which participate to the test.

The educational system is, by definition, a collaborative system. The collaboration exist between teachers and students, and between

teachers - teachers and students - students. In the figure 5 is presented the collaboration existing into a collaborative educational system:



**Fig. 5.** The collaboration into a collaborative educational system

The teacher offers to the student the information and the knowledge through the lesson. The student proves to the teacher that he has learned this information through the evaluation tests. Finally, the teacher offer the feedback through the score accorded to the student evaluation. [25]

### 6 Conclusions

The virtual campus is a metaphor for the electronic teaching, learning, and research environment created by the convergence of powerful new information and instructional technologies. Today there is a pressing call for technology to provide expanded higher education opportunities to a very wide spectrum of present and potential clientele. [21]

Comparing collaborative training with classical training is found that in the case of collaborative training assimilation of knowledge is made more efficient due process of learning within the teams.

In terms of technical issues, overall findings reveal that students in this high-tech environment rely on synchronous communication when in need of help or motivation but prefer asynchronous communication to learn content.

Methodologically speaking, it was found that students need a goal-oriented approach to learn and to appreciate new technology. [17] The field of virtual campuses and collaborative learning systems is a domain that has many published papers and that has acquired in the last period a great volume of theoretical knowledge. This provides the methods and techniques to analyze the problem, to identify the results, the agents, the components and, in the end, to define the architecture.

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