Collaborative Educational Systems

Cristian CIUREA

Department of Economic Informatics

Academy of Economic Studies, Bucharest, Romania

E-mail: cristian.ciurea[at]ie[dot]ase[dot]ro

Rodica BĂTĂGAN

General School No. 5

Rm. Valcea, Romania

E-mail: rbatagan[at]yahoo[dot]com

Abstract: *This paper starts describing the key concepts of collaborative systems and the impact of this to educational systems. There are presented the main properties and quality characteristics for the collaborative educational systems. For the main quality characteristic, like portability and complexity are presented different types of indicators for an educational system. The article analyzes different ways to increase the efficiency and the performance level in collaborative educational systems.*

Keywords: *collaborative systems, educational system, quality characteristics, metric.*

Collaborative systems

Collaborative systems are profoundly changing how research and creative activity are undertaken, for example by enabling distributed research, grid and cloud computing, simulation, or virtual worlds. They are also changing the organization of science, research, learning and innovation, by linking the creativity of peoples and allowing institutions to collaborate, pool distributed computing power and exploit new ways of disseminating information.

Collaborative systems are also transforming platforms for delivering news, entertainment and other information.

The collaborative systems affect every activity and suppose changes in all domains: in administration, in business, in education, in culture and in the manner of working.

Collaborative systems represent an interdisciplinary field at the intersection of economy, science, management, and sociology. Collaboration involves organizations that have a common mission and join together to form a new structure (Arba 2005).

A collaborative system is the system in which many users or agents are engaged in a shared activity, often in distanced locations. In the large family of distributed applications, collaborative systems are distinguished by the fact that the agents work together to achieve a common goal and have a great need to interact with each other in the sense that they share information, change requests, etc. (Dobrican 2005)

After criterion type of application, collaborative systems are classified into:

- collaborative systems in education: they are applied in the educational field and aimed at evaluating and enhancing the educational process performance;

- collaborative systems of defense: they are encountered in the military field and are characterized by strict rules of organization and functioning;
- productive collaborative systems: designed to increase production capacity and product quality in different units producing goods and services;
- collaborative banking systems: they are analyzed to determine factors affecting the banking system and its components.

The educational system, seen as a collaborative system, consists of three subsystems: physical, computer based and energy.

The physically subsystem consist of educational institutions, general school inspectorates, Ministry of Education, money and people. There is a very good communication and cooperation between these elements, provided by the staff from educational institutes and general school inspectorates and/or Ministry of Education. The staff from Ministry of Education develops rules, procedures, circulars, on which employees from educational institutions operate their activity. From the students' and parents' perspective, each educational institution is a separate unit, but from the Ministry of Education and general school inspectorates, all educational institution work as a whole.

The computer based subsystem, consisting of all software and hardware resources available to the educational institution for educational and administrative purposes.

The energy subsystem, consisting of the flow of electricity, Internet and intranet connections, alternative channels of communication.

When collaborative systems are used voluntarily, one of the key drivers to success is the manner in which users feel their experience with

the system: if they like, if the system offers them what they expect from him, if they are able to communicate freely and naturally with other participants, if they wish to recommend it to others (Ivan et all 2007).

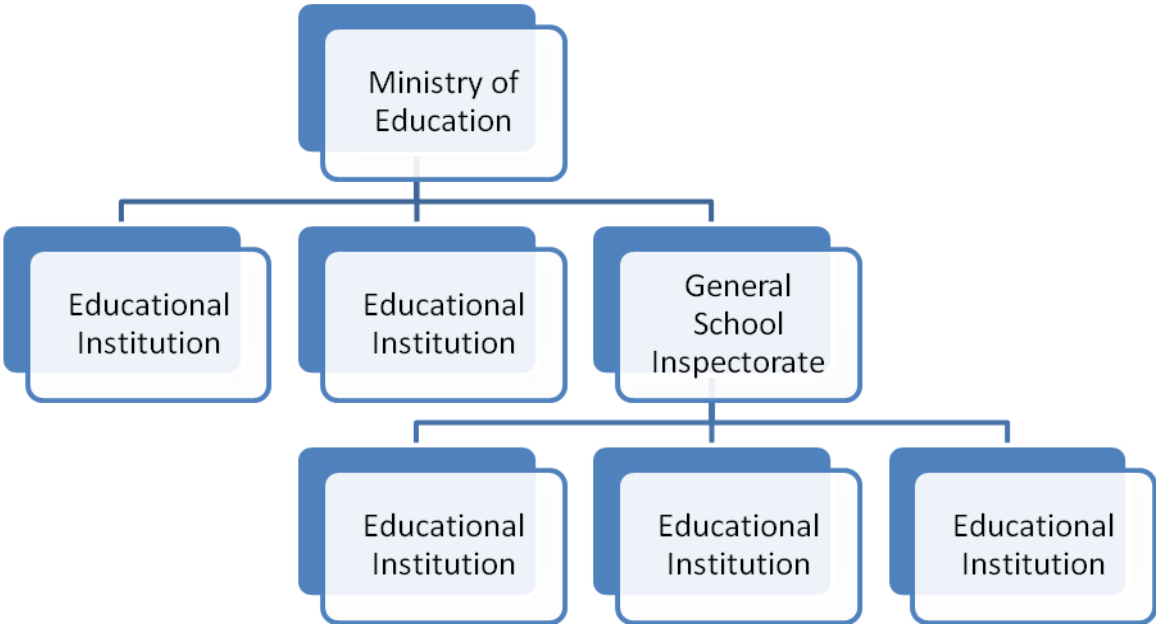

Figure 1—The physically subsystem of the educational system

Collaborative systems offer a new means of organizing and sharing resources. Collaborative writing systems are major benefits to reduce the time of completion for a particular task, reduce errors, get some different viewpoints and obtain a precise text. For collaborative writing of a document is a specific strategy: users can write independently or jointly to the document, as their work will be reviewed by another group of members.

Collaborative systems facilitate communication, processing, and transmission of information by electronic means and this plays a capital role.

On the other hand collaborative systems improve the educational systems. Collaborative systems help the teacher and the interlocutors to work together even if they are in different place. For example a training scenario can be imagined as follows: the instructor and trainee are in different locations, but both work in the same virtual space, space that contains the 3D anatomical models for a chemistry class. Each person interacts with each other through virtual space using a simulator that describes the physical and logical behavior of virtual objects on stage. The interaction is based on voice, gestures, actions surgical demonstration and step by step tutorials.

Quality characteristics of collaborative educational systems

The most important quality characteristics of collaborative educational systems are: portability and complexity.

Portability refers to the ability of educational system components to be transferred from one work environment to another. Portability for educational collaborative system aims:

- Portability of printed documents, refers to the degree of standardization and recognition at international level of models for each printed document;
- Portability of management, involves the transfer of a management model from a geographic area to another;
- Portability of procedures, involves measuring the generality degree of the procedures developed in a educational system and applying them in other educational systems or collaborative systems, depending on circumstances;
- Portability of staff refers to employees transferring from one

educational institution to another and from one geographical area to another area;

- Portability of processes, refers to the possibility of carrying out operations in various other conditions of work than usual and by others;
- Portability of software is the translation of various software components of the information system from a workstation to another.

The collaborative educational system is a system with high complexity, with a large number of components and a large variety of links between them. The complexity of the educational system is given by the operations they carry out, but also by the collaboration between different educational institutions from different countries and by the alignment to standards imposed by the regulations in this worldwide field. The collaborative educational system has components that can be represented by using a graph, the nodes being represented by these components, and the arcs by the links between components. The aggregated complexity of the collaborative educational system, CG, is given by the complexity of the subsystems that form it, CSS, and by the complexity of linkages between subsystems, CLS, as follows:

$$CG = \alpha * CSS + \beta * CLS,$$

where

$\alpha + \beta = 1$ and $\alpha, \beta \in (0, 1)$ are importance coefficients; (2)

In the collaborative educational systems are the following components:

- The material, which includes buildings, equipment and other property;
- The energy, consists of flow of electricity, Internet and intranet connections, alternative channels of communication;
- The information, comprising all software and hardware resources available to the educational institutions;
- The human, including the educational institutions human resources, the categories of personnel and the qualification levels of them.

Educational institution's results depend largely on the quality of staff and the efforts of each employee separately. For each position of the educational institution, the department of human resources is seeking people with a degree of training higher than required by the job in question. The goal of this recruitment is the elimination of cases in which an employee fails to meet certain requirements or to resolve certain issues related to its activity. Training of employees at work must be done at least every five years.

Regarding the collaborative educational systems, an indicator for increasing the efficiency is the level of staff training. Considering the qualifications period of five years, the minimum number of qualifications that get an employee is one in five years and the maximum number is one per year or five qualifications over five years. The maximum number of training sessions that the need to be financed, over a period of five years, is calculated according to the relationship:

NT = 5 * NP

where:

NT is the total number of training or qualifications

NP is the numbers of people employed and which are eligible for training.

The degree of increasing the level of staff and teachers training, GP, is determined according to the relationship:

$$GP = \frac{NC}{NT}$$

where:

GP is the degree of increasing the level of staff training;

NC is the number of persons qualified in the five years;

NT is the total number of training or qualifications supported by the educational institution

If we take into account the duration of trainings, in the formulas for calculation of the indicators will appear another two variables:

- Dmin = minimum duration of training, expressed in months;
- Dmax = maximum duration of training, expressed in months.

In this case, the total number of training sessions supported by the educational institution within five years, expressed in months, is given by the relationship:

NT = 5 * NP * Dmax

The degree of increasing the level of staff training will be determined with the same formula, with the difference that the number of persons qualified in five years is weighted with the duration of qualifications for each person. This indicator shows the collaborative educational system in terms of level of staff training and the quality of human resources.

Collaborative systems should work better than other types of systems.

Conclusions

The development of collaborative systems conduct to increase their complexity and the global character of the economy is designed to determine, also a global character for many of the collaborative systems. From the information point of view, to these global collaborative systems must correspond global performance indicators, procurement systems scratchy and data conversion procedures, to transform heterogeneous information into homogeneous entries for aggregate indicators, defined in the metrics of collaborative systems. Based on these aggregated indicators should decide appropriate to the global level, intermediate level and the execution level of any collaborative system organized into hierarchical levels.

A collaborative system creates an environment where people can work better together, can share information without the constraints of time and space, being characterized by three fundamental aspects: joint activities, sharing environment and way of interaction.

References

[1] Arba, R. 2005, "Collaborative Electronic Marketplace", in International Workshop Collaborative Support Systems in Business and Education, Cluj-Napoca, pp. 11.

[2] Austin, Choi, J., Rosen, J., Maini, S., Pierce, M. and Fox, G. 2008, Collective Collaborative Tagging System, "IEEE Grid Computing Environments Workshop, GCE '08", November 12-16

[3] Chang, V. 2008, Integrated use of Web Technologies to deliver a secure collaborative web portal, School of Electronics and Computer Science, University of Southampton, United Kingdom

[4] Dobrican, O. 2005, `An Example of Collaborative System`, in International Workshop Collaborative Support Systems in Business and Education, Cluj-Napoca, pp. 48.

[5] Ivan, I., Boja, C. and Ciurea, C. 2007, Metrici ale sistemelor colaborative - teorie si practica, Editura ASE, Bucureşti

[6] Sapena, O., Onaindia, E., Garrido, A. and Arangu, M. 2008, A distributed CSP approach for collaborative planning systems, Engineering Applications of Artificial Intelligence