e-EdU-Quality - Software Tools for Quality Management in Higher Education

IOANA MOISIL, CONSTANTIN OPREAN, CLAUDIU KIFOR, CIPRIAN CANDEA
"Hermann Oberth" Faculty of Engineering
"Lucian Blaga" University of Sibiu
Blvd. Victoriei 10, 550024 Sibiu
ROMANIA

http://www.ulbsibiu.ro

Abstract: - The knowledge society considers education and training among the highest political priorities. In order to achieve the goals set for 2010 by the Bologna Process national education bodies called upon universities to establish performance indicators to measure progress towards these goals. In our paper we are presenting the first results of a research project that aims to achieve a better quality management of all university's aspects through an advanced web-based, multi-agent, knowledge management system. The proposed system has advanced functions for extracting the quality indicators from the university data base, online analysis of indicators' values and for recommending the suitable measures in order to correct, if this is the case, inappropriate values of individual indicators. *e-EdU-Quality* system is based on the results of a former project – *eUNIV,* a project that transferred an e-business solution of knowledge management to the academic environment, and on the university information system, the pilot study being implemented on the university intranet.

Key-Words: quality of education, higher education, knowledge management, multi-agent system

1 Introduction

An Education Ministry regulation says: " each higher education institute from Romania (…) is the main responsible for the quality of educational services and also for quality assurance [1]…., taking the obligation that starting 2005/2006 universitary year to apply its own assurance quality system". Today, even more universities declare that they have a quality system, the most of them have this system only on papers and even they have a quality manual, procedures, the functionality of these systems is very poor.

At the European level, we can underline different stages for quality assurance and quality management in education [2]:

- Sorbona declaration (1998) referring to the European Space for Higher Education
- Bologna declaration (1999) is a pledge by 29 countries to reform the structures of their higher education systems in a convergent way until 2010 by promoting european cooperation for quality assurance.
- Lisabon convention (2000), pinpoint the idea of a competitive economic society based on knowledge.
- Salamanca convention (2001).
- Berlin declaration (2003), where is established that " the main responsibility for quality assurance in higher education belongs to each institution"
- Bergen convention (2005), a set of recommendations for guides, standards and procedures, national and international framework for qualifications, minimum number of ECTS, life long learning.

At the global level also exist interests for academic quality assurance. For example, UNESCO and OECD, are involved to elaborate and adoption some "orientations" regarding the quality of services offered by transnational institutions. The problem is to impose the quality not only the national institutions but also the transnational one. The interests for quality and e-learning technologies reside also from the national initiative called e-Fit Austria [3,4]. Some of the main objectives of this program includes: easy access to innovative services, high quality content for education, science, training and culture all this using the information technology to create a better and more efficient service for the educational system.

The relations between the European framework and national framework are based on transparency, visibility and comparability therefore any higher education institute is responsible to develop a culture

for quality which mean politics, techniques and practices consequently applicated and documented to obtain those results/performances in concordance with the proposed objectives.

At the European level and also at the international level are organizations concerned with the aspects of quality assurance in higher education: European Association for Quality Assurance in Higher Education (ENQA), the Nordic Quality Assurance Network in Higher Education (NOQA), the Network Agencies for Higher Education Quality Assurance from Central and Oriental Europe, the Network D-A-CH – created to prepare reciprocal recognition of credit decision taken by Austrian, German and Swiss Councils of Accreditation.

Today tendencies regarding higher education indicate the following: [5]:

- Within the competition on the european market regarding the number of the foreign students Romania goes down from 9th place (1980-1981), on 19th place (1994-1995), on 24th (2001-2002).
- The recognition of graduates' qualifications on labour market.
- Quick insertion of graduates on labour market
- Higher education growth – essential condition for national economies competitivity (in UE almost 21% have higher education degrees in comparation with 38% USA and 43% Canada).

The knowledge society considers education and training among the highest political priorities. In order to achieve the goals set for 2010 by the Bologna Process national education bodies called upon universities to establish performance indicators to measure progress towards these goals. In his visionary book "*What Will Be How the New World of Information Will Change Our Lives*", Michael Dertouzos, MIT Laboratory for Computer Science director for more than 30 years and science politics maker, has stated that: *The new world of information …is directly linked to the nuts and bolts of education through the acquisition, organization, and transmission of information and the simulation processes representing knowledge and through the use of approaches like e-mail and group-work that mediate teacher-learner and learner-learner exchange*. It is clear that education has to be the driving force, the one that catalyses and enables that all these changes take place in a natural, non-traumatic way and therefore there are demands for evidence of quality in higher education institutions that have to demonstrate, for the services they are offering, accountability and responsiveness to a heterogeneous range of user needs. At the level of a university we can distinguish three levels. The first step was to define an agreed set of criteria, standards and models for quality assurance and to identify the main critical success factors for self assessment in the university. The stakeholders in the quality process were identified, as their values will determine how quality itself is defined and measured. We are considering four stakeholder groups: policy-makers and their administration, educational entities providing programs or courses, teachers or trainers and students or trainees. Each of these groups has different interests leading to different perspectives on quality. For example, effective teaching as judged by a student may not be considered cost efficient in economic terms. We have considered the main facets of quality: *quality control* measures, implemented at the level of the university, standards and procedures for *quality assurance* and *total quality management* (customer focus; continuous improvement; quality assurance of internal processes; process orientation; and prevention instead of inspection). The objectives of quality were articulated in order to clarify the purpose of the pursuit and the indicators of quality defined. Quality indicators have been then specified. Most of the TQM indicators are relayed to the outcomes of education. The other indicators relate to control of resources, and of the educational content.

The purpose of indicators is twofold: they provide information to policy-makers to assist in policy formulation, and they demonstrate accountability. Specialists in quality assessment consider that indicators ought to be developed so that they are: policy-relevant, user-friendly (timely, comprehensible and few in number), derived from context, valid and reliable, and last but not least measurable at a reasonable cost. The European Commission Working Committee on Quality Indicators identified four main groups of quality indicators for the quality of education: attainment indicators, success and transition indicators, monitoring of school education indicators and resources and structures indicators (EC 2000).

2 General description of the system

Having specified and approved the group of indicators at the level of the university, we started several research projects in order to develop intelligent software tools to assist education quality audits and to make operational the ongoing process of university performance evaluation according to agreed measures.

We have developed a software application – *eUNIV* - for re-engineering an educational

organization, based on a business solution - eyeKNOW - developed for knowledge management in an enterprise by our industrial partner, *Wittmann&Partner Computer Systems*. The functionality of eyeKNOW has been extended to fit the requirements of an academic environment. eUNIV is a client-server, Lotus Notes Domino application The pilot site was a department of the faculty of Engineering. The first evaluation results have shown first of all that the solution is a feasible one. That means that strategies applied to optimize the overall activities in a commercial organization can be successfully applied, after customization, to an educational environment. eUNIV is centereed on the concept of project. A project is defined as a set of activities and tasks oriented toward a goal. Resources are allocated to each project. Some projects can share the same resources. eUNIV is a client-server, Lotus Notes Domino application. The eUNIV system enables not only a better management of all kinds of documents and projects, but it is an environment that allows educational staff to adapt to a new style of work: to share resources, projects, to cooperate without frontiers, in an organized and structured way. The pitfalls of the system are those of all attempts to standardization. The *e-EdU-Quality* system is enriching the eUNIV application with functionalities that allow to extract the quality indicators from the university data base, online analysis of indicators' values and to recommend the suitable measures in order to correct, if this is the case, inappropriate values of individual indicators. The general architecture of the system is presented in figure 1.

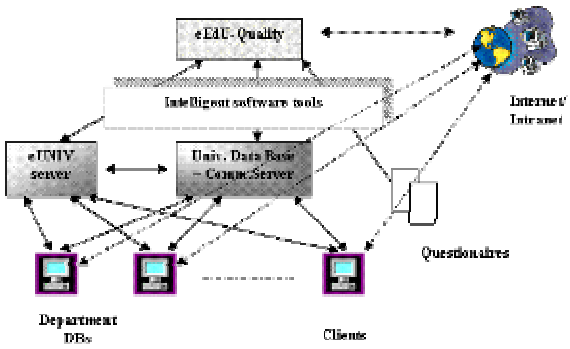

Fig. 1 eEdu-Quality architecture

2.1 eUNIV

Each project has a coordinator, a team and resources. For example, the project "Data mining and knowledge discovery in large databases" is an educational project. The coordinator is the professor teaching the course. The team is formed by 2 teaching assistants, the Student (student in the 4th grade) and a technician. The resources are: human resources, software and hardware, documentation, assessments. For this particular project the available resources are: one professor, two assistants, a technician, a network of PIII, eCache software, statistical software, OLAP demonstrators, a text-book in Romanian, practical work guidelines, references and on-line documentation. This is a minimum acceptable set of resources. If we check with the planned resources we will see that we need one more assistant, assessment tools (online and/or offline) and two networks linked to a powerful server. When the department is preparing the new academic year structure, a software agent is presenting a snapshot of the situation bringing to us the information we need. for example, all professors and assistants specialized in data mining, data mining software available in the department, the configuration of the networks in laboratories and the necessities for data mining practical works, how many workstations we need taking into account the number of hours/student and the number of students in the forth grade etc. Later on, when the timetable draft will be available, the system will provide alternatives for location of courses and practical works; the final decision being made by the time-table coordinator. Moreover the agent is checking the pre-requisite for attending the course. For example if the students in the 3rd grade didn't took a course on post relational data bases, they have to attend one before the enrolment to the Data mining course. All these operations being automatic they provide a valuable support to the department staff.

The system has access to the timetable from the Departmental data base. It is possible to locate a professor, student or assistant. For example, we can ask eUNIV the question: " Where is professor Ioan now? " . The system is checking the timetable for the day and hour and answers: "Room IE101, Faculty of Engineering, lecturing until 9.50" or " Reasearch work. Try his office". We can try also to locate any student and the system will provide us with the classroom location.

The access rights are allocated by the system administrator. There are four categories of access rights: public - anyone can access the information from the web or from a workstation, priority 0 (administrator and head of department), priority 1 gives accessb to the projects coordinators (access granted to all system information, but some only as read-only), priority 2 gives access only to the project information and the ones that are public, of course and priority 3, only to administrative and public

information. After the first evaluation it is expected that we are going to make the access more flexible, but for the moment we are keeping it like this.

Each project has an agenda, visible by all academic and non-academic staff, a mail-box, a special mail-box for students and a chat space, where colleagues can start less formal discussions.

The agenda is automaticaly updated by eUNIV. When a new event is announced, the agent is filling in the agendas of those implied. Suppose, For example, all agendas of the academics have marked for holydays a different number of weeks than the non-academic staff agenda.

2.2 eEdU-Quality

The main new added functionalities concern the integration at global level of procedures for *document management*, *work flow management*, *template management* and *knowledge sharing*. The result is the implementation of a centralized and flexible mechanism for document workflow, storage and easy retrieval using advanced searching procedures (based on project, subproject, associated object, key words, author, and date). Practically, one can simulate within the system any type of transaction or information workflow, from simple processes to the most complicated ones (educational, research and administrative). The document status in every stage is being followed, the system enabling each authorized member to find out at any moment where a document is and what is his status. Therefore, the entire activity each person performs can be tracked using the existing reports and the tasks fulfilled. Moreover, the module is "opened" to further future developments, depending on necessities.

Given the conditions in which the documents are created and stored (messages, emails, faxes, letters, activity reports, contracts etc.) and knowledge resulting from an institution intellectual capital is represented, the danger of loosing knowledge if a temporary replacement of a person is required (holiday, disease, detachment), is eliminated due to the fact that a large amount of those documents is stored and can be access anytime by the new person. The result is a simple and effective management, facilitated by the following processes: a) *unitary contact information administration* (adding, modifying, and retrieval) of the staff of the institution; b) *management of all types of documents* necessary in the daily working process – solution that integrates with the MSOffice suite and with other software products; c) *strengthening the work discipline* through standardization of documents and working procedures; d) *teamwork*, based on an intranet infrastructure with a distributed data base; e) *uniform administration of human resources*; f) *communication and cooperation*. The *work flow management sub-system* has two functions: *modelling* (managers can define processes and tasks, simulate and analyse them and assign them to people) and *execution* (end-user interface, work flow engine, execution environment for assisting tasks and processes coordination and execution). The *template database* contains templates for standard documents, standard texts and attachments. The *knowledge sharing function* enables, through different tools, knowledge identification and dissemination in accordance with rules and procedures. We are implementing six types of knowledge transfer: within the internal structures, from individuals to and from internal structures, within external structures and from individuals to and from external structures.

The system is implemented on a Lotus Notes/Domino server.

Information and data are collected from varia sources: questionnaires distributed to students and teachers, surveys, individual interviews, group discussions, forums, students' records from departamental data bases, qualifications and awards at different competitions, standards, policies and guidelines for education, minutes of meetings, reports etc. Some of these are collected automatically by software agents, from internal data bases and files and from a list of external web sites.

3 Intelligent software tools

Several intelligent software tools that assist the process of quality assurance and management have been developed and are in the process of implementation. Here is a list of the main tools:

- Students performance indicators extractor
- Electronic voting for the selection of grant proposals
- Quality evaluation questionnaires manager (questionnaires generator, distributor and analyzer)
- Advanced multi-agent system for dynamic routing of the grants' activities from a learning environment, based on the adaptive wasp colonies behaviour.
- resources management indicators

In the GRANT system, for example, the agents use wasp task allocation behaviour, combined with a model of wasp dominance hierarchy formation.

The model we have introduced allows the assignment of activities in a grant, taking into account the specialization of students, their experience and the complexity of activities already taken. An adaptive method allows students to enter in the Grant system for the first time. The system is changing dynamic, because both the type of activities and the students involved in the system change. Our approach depends on many system's parameters. For the implementation these parameters were tuned by hand. The Grant-system we built is integrated in a virtual education system, student centred, that facilitates the learning through collaboration as a form of social interaction.

In fact most of the developed tools are based on multi-agent technology. Multi-agent systems "envision a world in which autonomous, intelligent software programs, known as software agents, undertake many of the operations performed by human users of the World Wide Web, as well as a multitude of other tasks". The e-EdU-Quality multi-agent system infrastructure uses different kinds of agents: *interface agents* that interact with users, receive user input, and display results, *task agents,* that help users perform tasks, formulate problem-solving plans and carry out these plans by coordinating and exchanging information with other software agents, *information agents*, providing intelligent access to heterogeneous collections of information sources, and also *middle agents*, acting as intermediary between agents that request services and agents that provide services.

4 Conclusion

The knowledge society considers education and training among the highest political priorities. In order to achieve the goals set for 2010 by the Bologna Process national education bodies called upon universities to establish performance indicators to measure progress towards these goals.

In our paper we have presented an approach to quality management in higher education based on a set of software tools designed to assist the evaluation process. eEdU-Quality has the following main functions: *document management*, *work flow management*, *template management* and *knowledge sharing*. Several intelligent software tools assist the process of quality assurance and management, enabling to perform among other tasks those related to automate extraction of students' performance indicators and resources management indicators, the generation of questionnaires for assessing educational content quality, etc.

The system is under development, a pilot being tested with data from the master courses of the faculty of engineering (students' performance-evaluation of the quality of the educational process) and at the level of the department of research (e-voting for the selection of grant proposals). The first results are promising, though some problems have been detected at the level of integrating our system with existing department information management systems that have very simple document management components. These problems have been solved by giving eEdU-Quality access to non-aggregated department data.Further tests have to be carried on in order to assess the real value of the system.

References:

[1] Ordinul MEC Nr. 3928 / 21 aprilie 2005 privind asigurarea calităţii serviciilor educaţionale în instituţiile de învăţământ superior

[2] Nicolae Drăgulănescu, Motivaţii şi obstacole ale asigurării calităţii în învăţământul superior, Fundaţia Română pentru Promovarea Calităţii, Bucureşti, 2005

[3] Austrian Federal Ministry of Education, Science and Culture, Austrian Education News, 43/2005

[4] www.eFit.at

[5] Lazăr Vlăsceanu, Asigurarea calităţii în educaţie, UNESCO-CEPES, Bucureşti, 2005

[6] Alicia Tang, An Expert System in Quality Management System Documents Management and Internal Quality Audits, Asian Network for Scientific Information, Journal of Applied Sciences 5 (1): 130-137, 2005 ISSN 1607-8926, 2005

[7] M.L.Dertouzos, *What will be: How the New World of Information Will Change Our Lives*, HarperEdge, 1997

[8] D. Pallman, *Programming Bots, Spiders, and Intelligent Agents in Microsoft Visual C++,* Microsoft Press, 1999

[9] G. Georges, H.Hannoun, A.Leon, R. Toraille, *La formation des maitres*, LES Ceditions ESF, 1974

[10] Lotus Domino-IBM documentation

[11] Richard Y. Wang, A product perspective on Total Data Quality Management, Communications of the ACM, Vol. 41, No. 2, February 1998

Acknowledgement

This paper benefits from funding by the Romanian Ministry of Education and Research (INFOSOC - 93 CEEX-Modul I /2006)