Enhanced Mixed Campus and Distance Higher Education

Stefan Preitl, Radu-Emil Precup

"Politehnica" University of Timisoara, Bd. V. Parvan 2, RO-300223 Timisoara, Romania
stefan.preitl@aut.upt.ro, radu.precup@aut.upt.ro

József Gáti, Gyula Kártyás, Sándor Szénási

Budapest Tech, Bécsi út 96/B, H-1034, Budapest, Hungary
gati @bmf.hu, kartyas.gyula@bmf.hu, szenasi.sandor@nik.bmf.hu

Abstract: In recent years, several applications of modeling are proposed for the purpose of virtual classroom by authors active in this area. Considering one of them, the authors of this paper studied the possibilities and difficulties of introduction of model based distance learning into every day higher education practice. They surveyed some important issues and methodological elements of virtual classrooms in comparison with demands of higher education for teaching procedures, programs, and materials. The main objective was to reveal specific circumstances that allow definition of model objects appropriate for this special modeling. The paper is organized as follows. It starts with an introduction to application of features for description of course entities. Following this, local and global approaches of virtuality are discussed and main advantages of virtual education are noticed. Then practice related issues in classroom model are given. Finally, implementation as an extension in open surface application environments is discussed.

Keywords: Distance education, virtual classroom, Internet based higher education

1 Introduction

Great advances in Internet and browser related software technology stimulated development of distance learning. Internet based courses utilize potentials of advanced communication tools as media, knowledge technology, Internet, and human-computer interaction. Conventional distance learning uses books, pictures and moving pictures. Internet brought new resources as transfer of teaching materials between computers, hypertext in programmed presentations, e-mail, and chat. Author of [7] states that multimedia applications and network based

solutions brought about other aspects of learner's behaviours and encourage the introduction of individual based classroom or distance language learning.

Question that what is the next step in development in Internet mediated education is answered in [2] as advanced description of distance learning related objects as teaching programs, student schedules, teaching materials, etc. The next question is that why modeling can be a key solution for problems in distance learning. Some of the main problems are about review of huge amount information, quick change of teaching programs and materials, shortage of time at teacher and student, demand by students for individually configured and scheduled programs, etc.

Application of modeling makes utilization of advances in virtual technology possible. Virtual higher education is considered not only as a possible solution for problems of advanced distance learning but also as a solution for problems of campus style higher education. The authors of [1] and [2] propose a modeling method and model structure for virtual classroom. The authors of this paper discuss some of the related issues. The authors of [1] and [2] also considered several fundamental findings by other authors. Course structure in [3] supports adaptive course modeling. This is the main importance of the application of interconnected model entities. Associativities carry interconnections and define dependences amongst attribute values by simple relation, equation, rule, check, network or measure. Virtual university is considered as a place of teaching to fulfill special learning demands [4], as a system for teaching in an unlimited area using powerful computer networks [5] and one of the tools for reform in higher education [6]. A special purpose of the method proposed in [1] and [2] is higher education of engineers. The proposed modeling is considered as a chance to connect virtual environment of CAD/CAM/CAE systems with virtual classroom environments to establish and integrate virtual laboratories.

The paper is organized as follows. It starts with an introduction to application of features for description of course entities. Following this, local and global approaches of virtuality are discussed and main advantages of virtual education are noticed. Then practice related issues in classroom model are given. Finally, implementation as an extension in open surface application environments is discussed.

2 Application of Features for Description of Course Entities

Application orientation in modeling is best solved by features defined considering demands of individual applications. Recently, most of efforts in computer modeling were devoted to bridging the distance between theory of modeling and the practice at its application. In case of virtual classroom, entities must be

understandable for teachers, students, and personnel in offices. In other words, the new technology must be fitted into an existing teaching environment without any substantial disturbance in the on-going education.

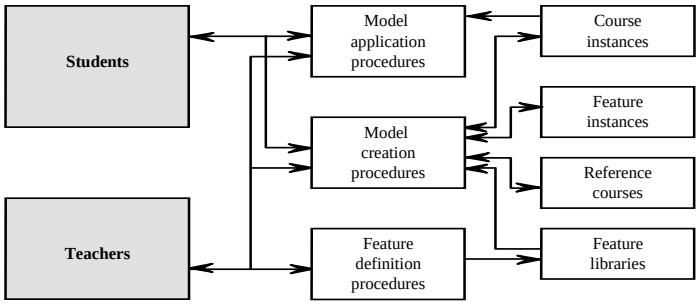

Figure 1
Features for course model

Advanced but not very complicated modeling is necessary that is understandable for participants of teaching and learning processes. Existing definitions and structures including accreditation must be implemented. A proven and successful method for definition of application oriented model entities is application of features as building blocks for model construction. In [2] an extensive application of the feature principle is introduced. Predefined classroom features are defined, elaborated, and applied for the modification of virtual classroom modules to create module instances for custom teaching programs.

The feature-based scenario of course modeling is outlined in Fig. 1. Features are defined then applied at creation of courses. Reference course acts as a predefined structure of entities for a typical course. At the same time, predefined features as course entities are stored in feature libraries. Modeling procedures create reference or instance course structures, feature instances, and modify courses by using of feature instances. Model application procedures execute course instance models and support virtual classroom activities.

Implementation of the above outlined method is possible when reference course and feature definitions cover the information content and flow of practice. In this case, advanced theory and methodology by teachers are utilized by an efficient system.

3 Local and Global Approaches

An important characteristic of higher education is an emphasis on local excellences. This can lead to conflict of local and outside world systems in a computer system based education environments. This is why definition of local

and global virtuality in [2] is so important. Virtuality has been defined on two levels of a teaching and learning system (Figs. 2 and 3). On level one virtuality refers for a system in the virtual world within an actual computer system. Level two of the virtuality is for a system that applies resources from teachers at different geographical sites. Latter is important because same quality of teaching and learning cannot be offered for students in many different topics by the same higher education institution. While mobility of students and teachers is still very important, it is impossible to handle all demands by mobility.

Global virtuality can be implemented when information for appropriate accreditation can be acquired. In this case, more or less flexibility of involving outside teaching resources is allowed by the accreditation. One of the problems solved by global virtuality is that continued utilization of teaching after a mobility at the same institute is often impossible. A mixed application of the virtual university and mobility at the second level of virtuality seems as the best solution.

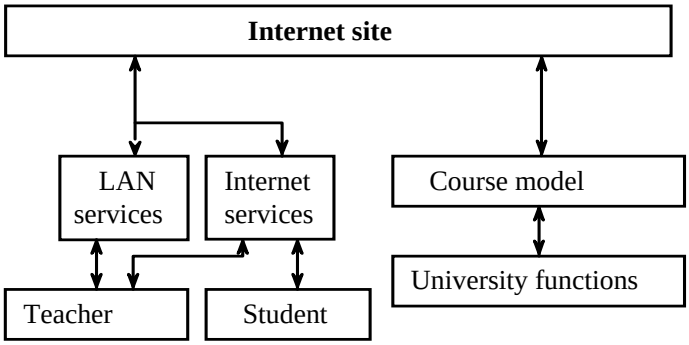

Figure 2
Local virtuality

Local virtuality (Fig. 2) supposes teaching resources are accessible from a single Internet site. University functions are governed by course descriptions [6]. Course model consists of instances of generic resources. Student communicates with the system using Internet services. Exchange of information within virtual classroom is handled by local network. Teachers initialize interactive sessions from remote points.

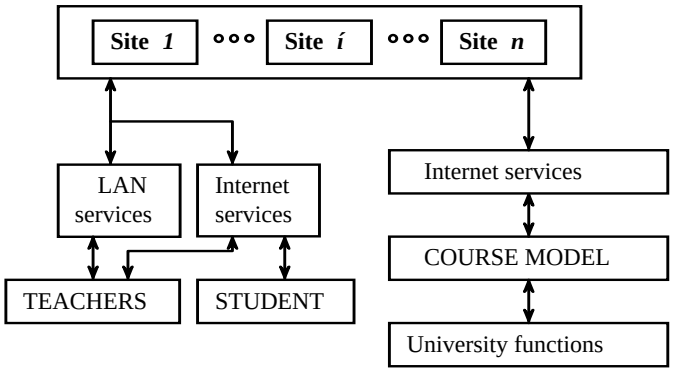

Figure 3
Global virtuality

4 Practice Related Issues in Classroom Model

Teaching, Internet and modeling are traditionally or recently communication intensive. The authors of this paper analyzed communication structure in a virtual classroom according to the concept in [1]. The authors of [1] established a simple model structure with its main components and attached essential communications to the components. Teachers, students, and people in outside sites communicate classroom model, course instance model, and outside world model, respectively. The structure is completed by relationship definitions (Fig. 4).

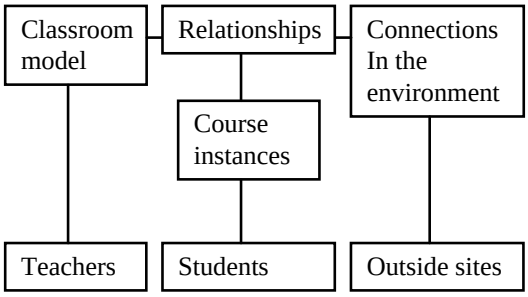

Figure 4
A quick glance to course modeling

Relationships describe connections revealed between course entities or their attributes. Classroom, course instance and outside world descriptions are connected with teachers, students and outside sites, respectively. The communication medium is the Internet. Local demand and decision originated attributes of virtual classroom entities are defined as constraints.

The main benefit of modeling can be achieved by student profile based instancing of courses. In other words, a course feature instance is elaborated for a student request. In this case, the request may come from individual demands and prerequisites, and other specifications by accredited courses. When it is allowed, a student may have multiple course instances.

A course feature instance can be defined as a complex structure or even as a single topic. Topic feature serves as basic unit of course feature and consists of concept, method, implementation, equipment, and opinion entities associated with teaching material and publication entities. Assessments are modeled as submitted works, on line exams, and conventional exams.

The virtual classroom offers services for students as the conventional classroom. Teaching procedures rely upon services. Main categories of services are virtual lecture, seminar or laboratory, teaching material service, off line and live consultation, submission in writing as assignments, interactive learning and programmed training.

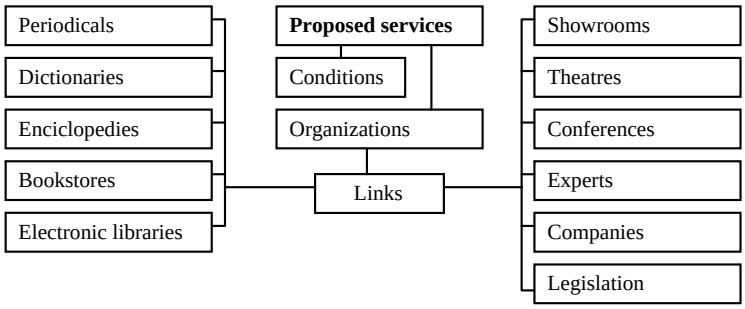

Figure 5

Connections in the environment for services

Curriculum cannot be fully served by knowledge representations included in the course model. Referred knowledge sources are applied by communication with the outside world (Fig. 5). Strength of virtual classroom is among others in its ability to organize outside teaching resources in Internet based course programs. It is impossible to reproduce all the necessary knowledge and experience generated in the ever-changing world of industrial related practice within a course.

Contradicting aspects of flexible course profiles and constraints must be harmonized in efficient virtual teaching procedures. Constraints in the classroom model are relationships of entities and their attributes, fixed entities and links. Constraints may be defined by any participants of the higher education system considering a decided hierarchy. Legislation and government act through higher education related laws, etc. Constraints by accreditation are activated for degrees. Internal measures within an institution must be considered. Main participants of the teaching are teachers. They define requirements within modules for high level of purposeful education. Prospective or actual employers of students may also

define constraints. Finally, students define what they would learn within a restricted area.

In [1] the authors proposed a new structure of interrelated components of a virtual classroom. They placed main emphasis to curriculum to describe content, conceptual structure, and time for degree programs. Other groups of components make description of teaching processes, credits, students, and virtual laboratories possible (Fig. 6). The result is grounded both theoretically and methodologically.

Virtual classroom is developed for a well-elaborated curriculum then it is modified by changes of developing curriculum. Curriculum is defined in the literature as an organized learning experience. It describes content of a degree program, provides conceptual structure and time frame to get that degree. At definition of a curriculum, specifics of virtual classroom must be taken into account. Curriculum is considered as consisting of courses. Similarly to curriculum, a course can be defined as an organized learning experience in an area within an education program. Curriculum involves a constrained choice of modules, blocks and topics. As for its structure, a course is a sequence or network of modules. A module consists of blocks. A block involves topics. Core studies contain basic and essential knowledge in the form of modules or blocks. These entities can be applied to compose courses or can exist individually upon student requests.

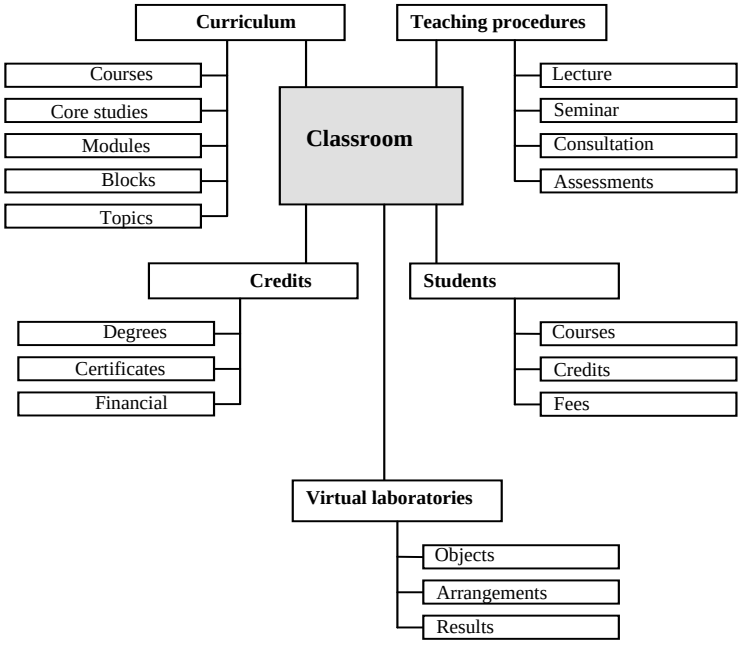

Figure 6

A possible set of entities in classroom model

Teaching procedures are lectures, seminars, consultations, assignments, and assessments. Additional implementation based teaching procedures can be defined in classrooms. Credit information involves degrees and certificates defined by requirements as well as financial conditions information. Students are featured by course, credit and fee related information. Virtual laboratory consists of software modules, arrangements of the objects and results of student work as assignments and degree works.

5 Implementation as an Extension in Open Surface Application Environments

Most of the possible pitfalls in a change for virtual education is expected to be around implementation. The authors of [2] proposed a solution for affordable implementation of virtual classroom modeling. They consider virtual classroom as an extension to existing modeling and Internet portal software products in the form of virtual classroom modeling extension (VCME). VCME utilizes functions of modeling, virtual university and Internet software.

An example for potential applications of the proposed virtual classroom is teaching of principles, methods, and practice of engineering modeling. An engineer communicates modeling procedures to create model entities such as form feature entities for model of a mechanical part. The resulted model is developed and applied by other engineers applying other modeling procedures. Engineers are in interactive graphics dialogue with modeling procedures. Modeling systems have open surface for their development in application environments. At the same time, some existing and utilizable elements of CAD/CAM systems as tutorials serve educational purposes. These systems include modules for Internet communication for group work and other contact with engineers in the outside world. Product model entities are connected by using of relationships between entities and their parameters as it is proposed for virtual classroom entities. Effect of a change of a model entity is experienced in a comprehensive integrated structure of entities.

In the case of an engineering application, implementation of a virtual classroom is considered as an extension to existing modeling and Internet portal software products. An affordable system development and work of students in an environment similar to as in the industry can be achieved. An industrial engineering modeling system consists of a set of modeling procedures, a model database, a user interface, tutorials, Internet based group work procedures and application programming interface (API). API serves as a tool for the development of extension to an industrial system by new programs written in own development environment of the modeling system or by using of other development tool set. Other program products for an engineering purposed virtual classroom

environment are configurable virtual classroom software and Internet portal software tools. A thorough study of this application of virtual classroom is planned in the future.

Key issue for implementation is management in virtual classroom. A virtual classroom concept is introduced in [1]. This concept applies managers for main virtual classroom tasks (Fig. 7). Virtual classroom involves a set of managers for different functional tasks. Course manager handles modules of the teaching program. A module involves topics. Enrollment manager works with credits of student work if it is needed. This manager administrates fees too. Communication manager's tasks are related to communication tools amongst teachers and students. Teaching material manager downloads materials, offers on line video service, sends materials by E-mail automatically, and gives links to outside sources of materials. Support and license manager establishes connection with producers of modeling systems and administrates licenses. The data security manager coordinates data security and related tasks. Installations use mainly configurable and open architecture professional software for managing purposes. The most important ones are Internet tools and the related applications. Course model is a structure of modules and topics of the teaching program as it is discussed above in this paper.

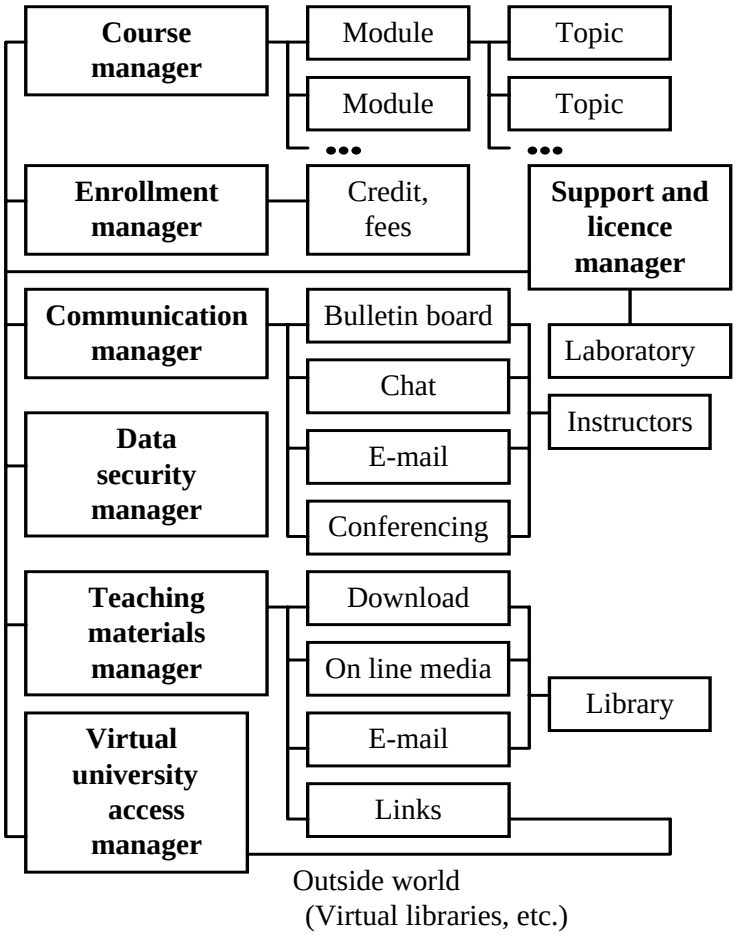

Figure 7

Managers and managed functions

Essential methods for virtual classroom modeling are summarized in Fig. 8. Virtual and Internet methods are applied. In other words, the base of the proposed method is constituted by classroom model and Internet communication. Virtual methods are applied for creation and handling classroom features as building blocks, modification of classroom descriptions by features, and creating relationships between features. Internet methods serve special browsing, application services as database, service providing for customers, and searches by general and special purpose engines.

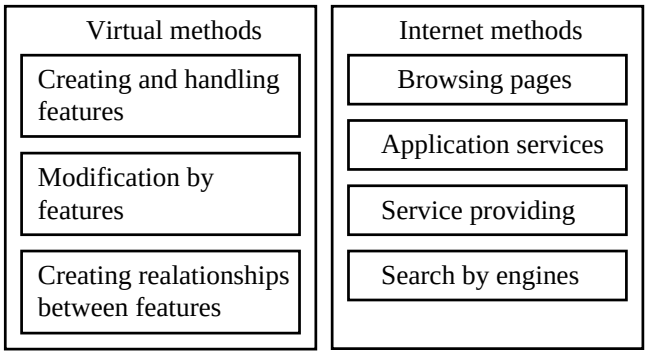

Figure 8
Methods for classroom modeling

Conclusions

An outline of model based advanced distance education is given in this paper. Demands for education in engineering are preferred. Nevertheless, the cited and analyzed methods can be also applied in other areas. Main concerns are around conditions and circumstances of application of virtual classrooms in every day higher education practice. The authors did an application-purposed survey of an early-proposed virtual classroom modeling. They stated some relevant results for evaluation of cited characteristics of that classroom modeling. Among others, structure of the virtual classroom for practice, definition of classroom entities for real world teaching content, managing of virtual classroom, covering purposes of a conventional higher education environment, and a critical evaluation of a proposed set of classroom entities have been evaluated. As a conclusion, virtual classroom is a prospective tool to enhance, integrate and organize campus and distance types of higher education. At its implementation, the virtual classroom needs high number of practical considerations both in content of courses and integration in application oriented software system.

References

[1] L. Horváth, I. J. Rudas, O. Kaynak, "Modeling Virtual Classroom for Education in Engineering.," in *Proc. of 2nd International Conference on Information Technology Based Higher Education and Training*, Kumamoto, Japán, 2001, pp. 395-398

[2] I. J. Rudas, L. Horváth, "Course Model Based Distance Higher Education of Engineering Modeling," in *WSEAS Transactions on Advanves in Engineering Education*, ISSN 1790-1979, New Yersey and Athens, Vol. 1, No. 1, pp. 67-72, 2004

[3] L. Horváth, I. J. Rudas, "Adaptive Virtual Higher Education Space for Engineering Modeling," *WSEAS Transactions on Advances in Engineering Education*, Issue 2, Volume 3, February, 2006. pp. 99-104

[4] Richard Teare, David Davies, Eric Sandelands, “The Virtual University: An Action Paradigm and Process for Workplace Learning”, *Cassell Academic*, 1999

[5] Starr Roxanne Hiltz, The Virtual Classroom, "Learning Without Limits Via Computer Networks", *Human/Computer Interaction*, 1997

[6] Gerald C. Van Dusen, “The Virtual Campus, Technology and Reform in Higher Education”, *George Washington University School of Education & Human Dev*., 1997

[7] Andrea Tick, „From Computer Assisted Language Learning to Computer Mediated Language Learning,” in *Proc. of the 4th Slovakian – Hungarian Joint Symposium in Applied Machine Intelligence*, SAMI 2006, Herlany, Slovakia, 2006, pp. 405-413