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Virtual Teaching Procedures on the Internet

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Abstract – A definite need of students and people demanding regular learning of new advancements in different areas of practice increased the emphasis on distance learning in higher education during the last decade. Internet and modeling techniques from the advanced information technology offer high amount of methodological elements well appropriate for distance learning in an integrated virtual and Internet environment. One of the latest advancements in this area is published in [1], [2] and [3]. Considering some basic concepts and methods from the proposals of the authors of these papers, this paper gives some methodological elements and details necessary for the implementation of the proposed method in the higher education practice. This paper starts with an introduction of feature-based course modeling in model based distance education. Following this, practical considerations for the implementation of concepts local and global virtualiy are discussed. Next, structure and connections of course model entities are detailed including the basic communication structure. Finally, higher education practice related issues are explained for implementation including essential classroom methods as well as managers and managed functions.

Key-Words: - Distance learning in higher education, Virtual classroom, Course modeling, Internet based education, Management of course.

1 Introduction

As advanced communication developed and changing knowledge in industry and other areas of activities demanded more and more distance education, experts involved information technology, multimedia, knowledge technology, Internet, and human-computer interaction methodology in development of efficient virtual education. 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. The question that what is the next step in this development 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 large 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], [2], and [3] propose a modeling method and model structure for virtual classroom. The author of this paper discusses some of the related issues. The authors of [1], [2], and [3] also considered several fundamental findings by other authors. 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]. Virtual teaching methods are applied to solve problems at training of High-Tech topics [7]. Some experiences with e-learning are reported by the authors of [8].

A special purpose of the method proposed in [1], [2], and [3] 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.

This paper starts with an introduction of feature-based course modeling in model based distance education. Following this, practical considerations for the implementation of concepts local and global virtualiy are discussed. Next, structure and connections of course model entities are detailed including the basic communication structure. Finally, higher education practice related issues are explained for implementation including essential classroom methods as well as managers and managed functions.

2 Feature-based course modeling

In early applications of computers for the modeling of well-defined objects, efforts to bridge the distance

between theory and practice of modeling at its application grounded present day modeling. 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.

Modeling cannot be a very complicated thing that is not understandable for participants of teaching and learning processes. Instead, 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.

Procedures and resources for the feature-based way 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.

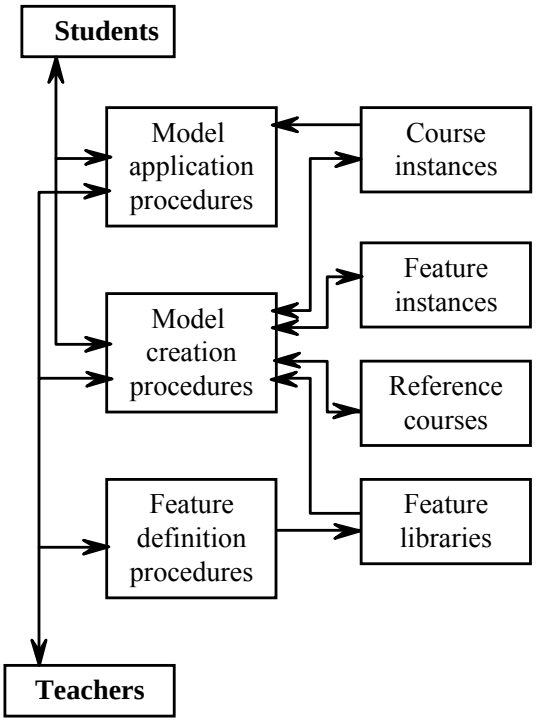

Fig. 1. Features for course model

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 is utilized by an efficient system.

3 Local and Global Views in Virtual Higher Education

Cooperation of local and outside worlds a case of computer system based education environments brings a lot of problems even conflicts. 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 the 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 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 best solution.

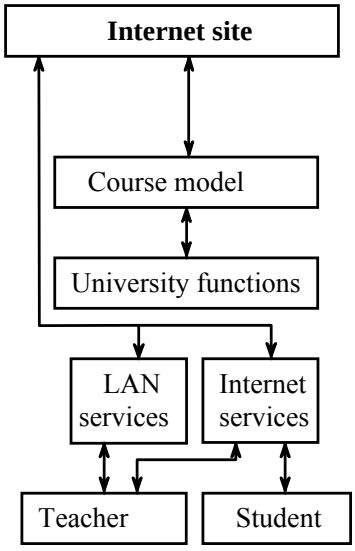

Fig. 2. Local virtuality

Local virtuality (Fig. 2) supposes teaching resources accessible from a single Internet site. University functions are governed by course descriptions [5]. Course model consists of instances of generic resources.

Students communicate with the system using Internet services. Exchange of information within virtual classroom is handled by local network. Teachers initialize interactive sessions from remote points.

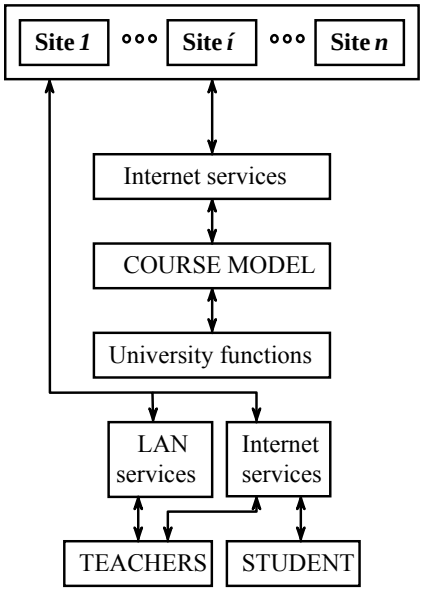

Fig.3. Global virtuality

4 Structure and Connections of Course Model Entities

Classroom objects are to be described by a highly interconnected set of entities. Concept of one of the possible communication structures was published in [3]. The authors 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).

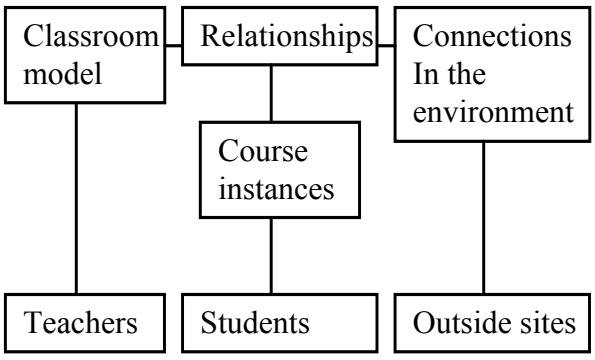

Fig. 4. A quick glance to course modeling

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. 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.

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.

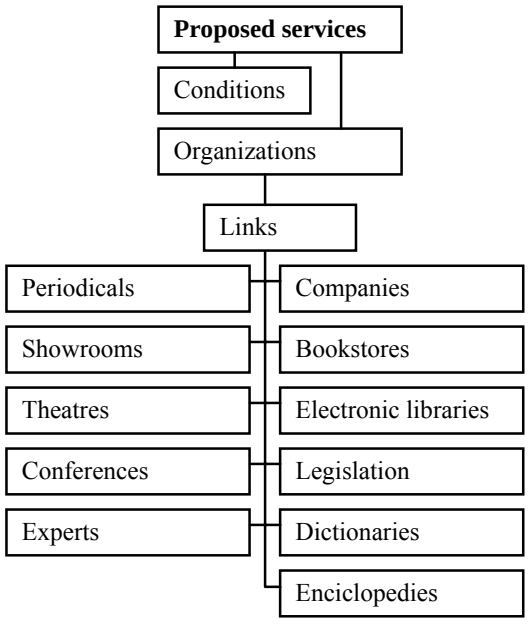

Fig. 5. Connections in the environment

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.

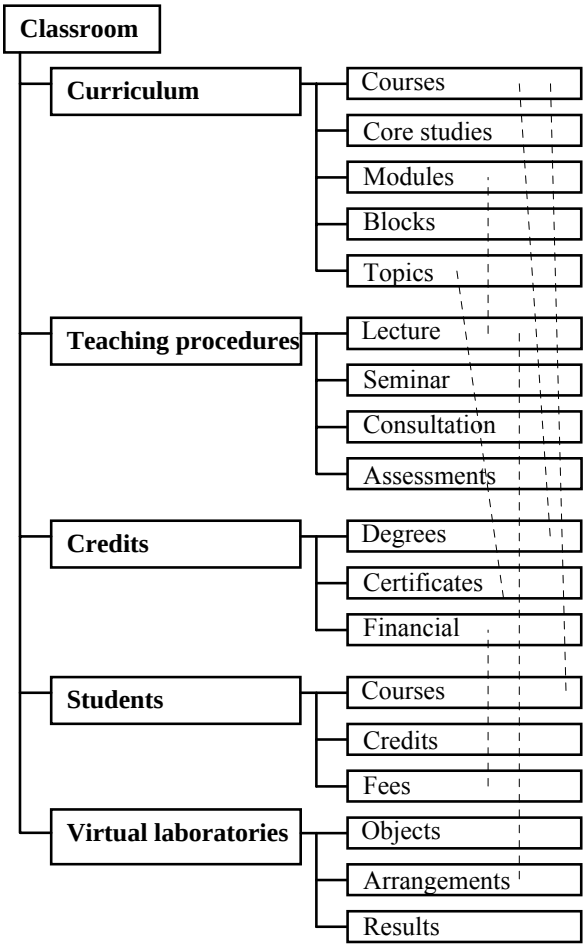

Fig. 6. Classroom model entities

In [1] the authors proposed virtual classroom as the starting point of an existing curriculum. Virtual classroom consists of curriculum, teaching procedures, teachers, students, and virtual laboratories. A new structure of interrelated components of a virtual classroom has been established. They placed main emphasis to curriculum to describe content, conceptual structure, and time for degree programs. Other groups of components describe teaching processes, credits, students, and virtual laboratories. Fig. 6 outlines groups of entities in classroom model with several direct connections revealed by the author during an analysis considering possible implementations of the model. A set of relationship definitions may be a solution as it is proposed between attributes of entities in [3]. 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.

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 Higher Education Practice Related Issues for Implementation

The authors of [2] proposed a 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. Using of relationships between entities and their parameters as it is proposed for virtual classroom entities connects product model 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 detailed study of this application of virtual classroom is planned in the future.

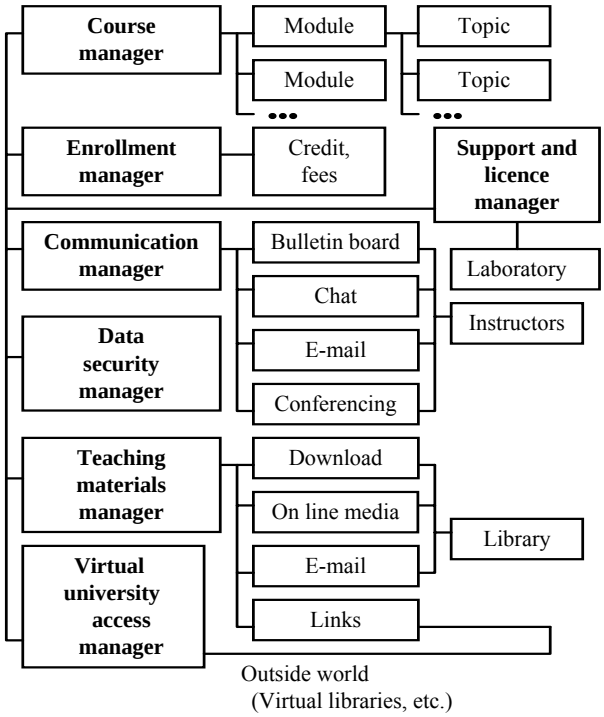

Fig. 7. Managers and managed functions

Extensive application of course management is introduced in [1]. Using the virtual classroom concept by the authors of [1], resource data, model data, and modeling and other procedures are managed by managers organized for main functional areas in the virtual classroom. For example, course manager handles structure and elements of teaching programs. Virtual classroom involves a set of managers for different functional tasks (Fig 7). The author analyzed application of managers to handle activities around teaching program. A module involves topics for a wide range of teaching content. 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.

As a final consideration, essential methods for virtual classroom modeling are summarized (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.

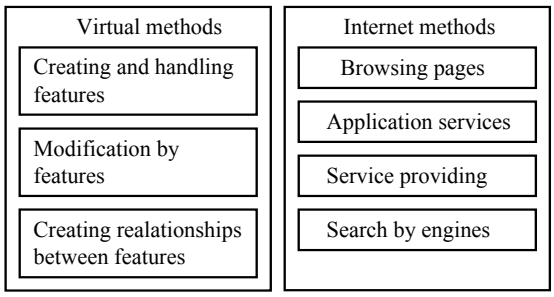

Fig. 8. Methods for classroom modeling

6 Conclusions

Establishing virtual classrooms in higher education practice is the main topic by the author of this paper. An application-purposed analysis and survey of an early-proposed virtual classroom modeling have been

conducted. The author of this paper explained some results of an evaluation of cited characteristics of that classroom modeling as 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 the proposed set of classroom entities. Main conclusion of the reported work is that application of virtual teaching methods in higher education enhances, integrates and organizes campus and distance types of activities. Additional practical considerations are to be considered for effective virtual classrooms.

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