# Student Profile Based Virtual Classroom

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*Abstract: Computing brought new possibilities to define, storage, retrieve and communicate knowledge in computer system based teaching from simple personal application of computers to teaching organizations in computer networks. 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] and [2]. 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. Paper starts with an explanation for managed functionality of a virtual classroom. Following this, configuring and constraining classroom models are discussed. Finally, entities for course model and procedures for operating a classroom are detailed.*

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

## 1 Introduction

Advancements in description of real world physical and logical objects in computer systems inspired activities to define and organize virtual teaching. Virtual classroom is the most frequent term for computer based teaching and learning environments. It is considered and developed as an advanced form of distance learning [4]. Published lectures, course materials, assignments for homework, on-line conferencing or consultation, and live chats are applied as resources of a classroom [5]. Model of a classroom must describe these resources. At the same time, virtual classroom is demanded to offer the same services as a conventional classroom. However, browseable teaching materials, links inserted for background information, and other possibilities of an Internet based system facilitates introduction of much more services as a conventional classroom. At this point, the authors propose placing an emphasis on integrated application of virtual

and conventional classrooms both in campus and distance programs. Moreover, hybrid campus and distance programs can be configured.

Frequent and substantial changes of industrial technology require lifetime learning. The time that can be devoted by practicing people for this purpose is very restricted. This requires efficient Internet based solution and substantial computer resources both at classroom and student sides. Companies engaged in development, production or consult of engineering modeling and other areas are interested in participation of employee at efficient higher education courses. However, they may offer substantial computing and knowledge resources.

A virtual university approach and method in [1] uses managers and course models. Course model describes teaching program and student profile as a structure of modules and topics. Managers are for main groups of functional tasks in a virtual classroom. This paper involves some additional considerations and methodological details based on the above-cited approach and method. It starts with an explanation for managed functionality of a virtual classroom. Following this, configuring and constraining classroom models are discussed. Finally, entities for course model and procedures for operating a classroom are detailed.

## 2 Managed Functionality of a Virtual Classroom

Virtual classroom utilizes both description and managing techniques. Cooperating managers of a virtual classroom, as they are presented in [1], supervise virtual classroom resources. Each manager handles a well-defined functional area. Because versatile course based on student profile is considered as a primary power of the proposed virtual classroom, role of the course manager is essential. It is very important to fit course descriptions and course handling procedures to practical demands of field teaching. This is possible only by effective communication between teachers and the virtual system. Two basic levels of a course model contain modules and topics (Fig. 1). Modules and topics are stored as objects in libraries. They are mapped to courses by single or multiple mapping. Mapping must be free for flexible configuration of courses by teachers. However, numerous constraints must be taken into account. Constraints restrict application of modules in courses and topics in modules. For example, modules are placed in courses considering prerequisite modules. Definition and description of a module may depend on the implementation environment.

Enrollment manager administrates mainly freshmen while main functional areas of the registrar manager are results by students and fees. Function areas of these managers depend on the institution where the model is implemented. A serious mistake would be firm predefinition of functional areas of these managers. Communication manager controls and organizes teacher-student communication

processes. Teaching material manager gives tools for download of materials, offers on line video service, sends materials by E-mail automatically and offers links to outside sources of materials. The support and license manager establishes connection with producers of modeling and other application systems and administrates licenses. The data security manager controls data security processes.

Modules are arranged in courses or handled individually. Advanced achievements in virtual classrooms can be virtual lectures and laboratories in the future. The course manager handles them. Process manager supervises generally applicable as well as application area and implementation specific processes in managing of courses. Fixed or typical sequences of processes can be defined as complex managing tasks.

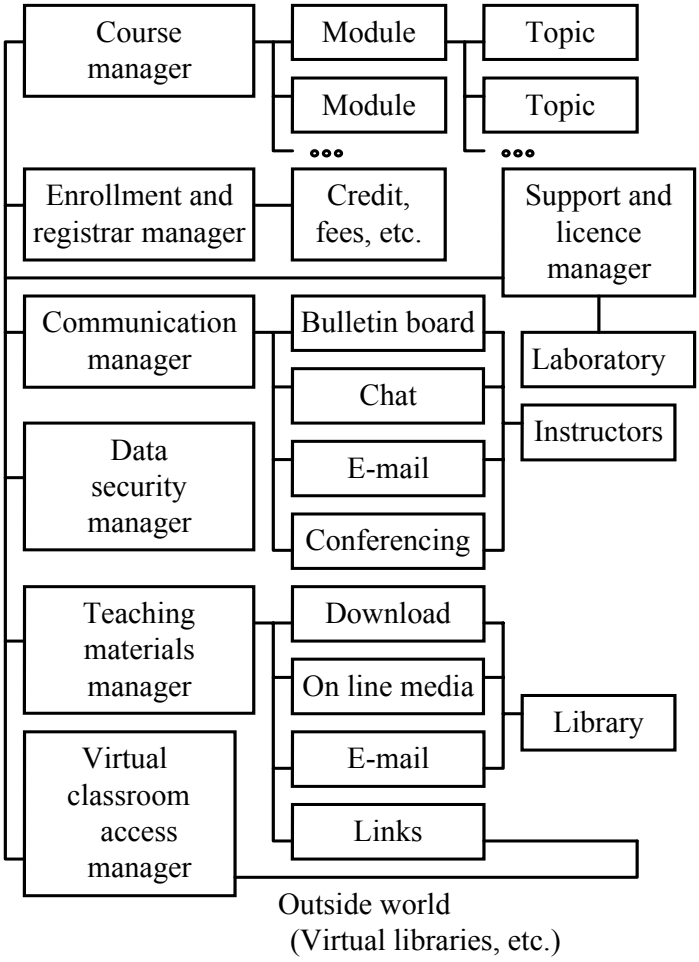


Figure 1
Structure of managers

# 3 Configuring and Constraining Classroom Model

Virtual higher education is highly based on conventional e-learning. An application and methodology of multimedia platforms in e-learning are explained in [6]. Some experiences with e-learning are reported by the authors of [7]. Implementation issues and experiences of e-learning technologies in higher education require special consideration [8].

The method published in [2] applies generic course definitions to describe a set of similar courses. Course model for a student or a student group profile is created in the form of course instance during an evaluation of a generic course. In the above-cited method, student demand based course definition applies three predefined resources. They are generic and earlier created instance courses and course modification features. In other words, instance courses are applied directly or they are modified by course features. Generic course definitions are introduced by the authors of [2] applied to describe a set of similar courses. Generic course model is evaluated and model of course instance is generated for a student or student group profile.

Definition and selection of courses (Fig. 2) are done by using of predefined course and course element definitions. These entities are available in the modeling system. Generic course describes a set of similar courses. Course elements can be arranged in network to be evaluated to gain course instance. Sometimes simple precedence rules can be used to create instances. It is not allowed to make any modification of instance courses by course modification features that contradict the related generic course definition. In other words, extension of custom tailoring is restricted by higher priority factors included in generic course definitions. At the same time, feature principle is also applied at definition of generic courses and creating course instances.

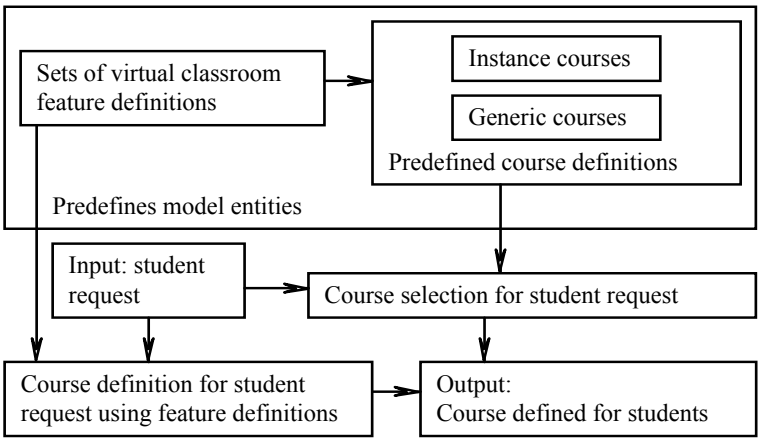


Figure 2
Selection or definition of a course

Restrictions on definition and application of a course are defined as constraints (Fig. 3). Any participant of a higher education system may be authorized to define them. Previously decided relationships and fixed entities, links, and attribute values are represented in a classroom model as typical constraints. Other constraints can be originated by legislation and government act through higher education related laws, etc. Accreditation related constraints are applied at education for degrees. Measures within an institute also control teaching activities by constraints. Teacher requirements related constraints are active within modules. In a well-organized education, prospective or actual employers of students may also define constraints. Finally, students define what they would learn within a restricted area. Fig. 3 shows a typical hierarchy of constraint sources.

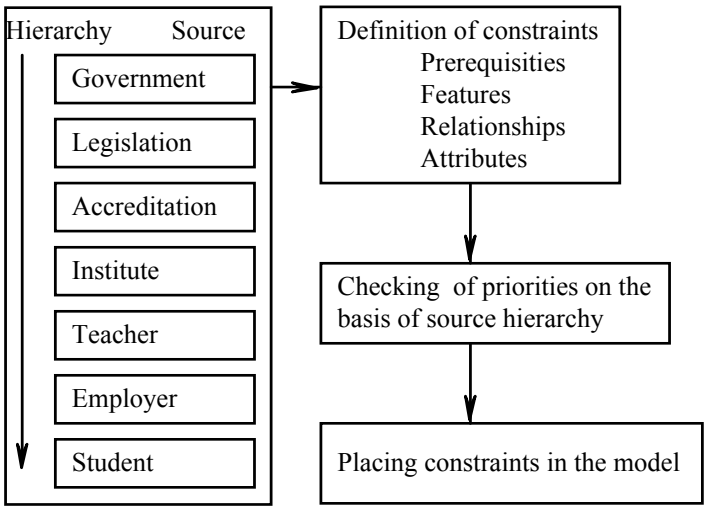


Figure 3
Constraints in classroom model

# 4 Course Model Entities and Classroom Procedures

As it was stated above, a course is a sequence or a network of modules. Block as an entity between module and topics can be introduced when it is demanded by complex structure of a module. A block consists of a group of topics. Authors of [1] proposed a method to describe a topic that supports teaching practice and applies principles, methods, relationships, questions and other practice related entities. Consequently, a topic is processed by using of topic related procedures for handling principles, methods, relationships, examples, questions, materials and instructor activities (Fig. 4). Links can be defined to other topics and outside world objects. Modules are arranged in courses or can be applied individually.

Core studies can be defined for basic and essential knowledge as modules or blocks. Finally, a course model offers a reduced choice of possible modules, blocks, and topics.

An earlier analysis of classroom revealed its components and resulted entities of course model as curriculum, teaching processes, credits, students and virtual laboratories [2]. Consequently, a virtual classroom is much more than a set of course descriptions. Curriculum as an organized learning experience involves content of a degree program, provides conceptual structure and time frame to get that degree. The course is an organized learning experience in an area of the education. A curriculum is composed using courses or courses are defined according to predefined curriculum. Virtual laboratory is proposed in [1]. It allows students to participate in laboratory hours from remote computers within a virtual higher education system. Individual and group work tasks, directed drills and case studies can be made available for students. Virtual laboratories are composed by using of software modules, software arrangements for assignments as well as results of student work as assignments and degree works. Virtual classroom is active in an environment where students, teachers and related humans and objects from the outside world are integrated. Classroom model, course instance model, and outside world model communicate teachers, students, and outside sites through the Internet.

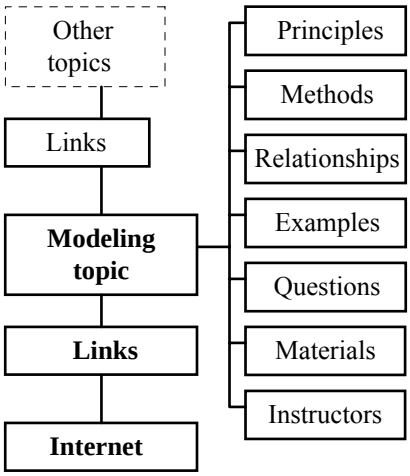


Figure 4
Structure of a topic

In [2] modules are proposed to be grouped in tracks facilitating a versatile means of course description. Modeling is outlined in Fig. 5. Implementation in practice is supported by application of the feature principle well known from engineering modeling. Authors of [3] apply predefined virtual classroom features as modifiers of course modules to achieve teaching program fulfilling requirements by

accreditation, institution, teacher, and student. A course model includes structure of its elements, feature driven construction of modules, and associativities between course elements. A track has been introduced as a course element comprising a set of modules for a well-defined purpose. Tracks and modules may be applied in several course instances with no duplication of classroom model entity descriptions.

By application of feature driven modeling, a module is considered as a base feature. It is modified by module modification features to create a customized module instance. A purposefully selected choice of possible module modification features and allowed modifications constitute main content of a course. The teachers engaged in the related teaching program define this content. Customization provides modules that include student demand originated content in an extent as possible. Consequently, generic models are applied and used at creation of their instances. At the same time, types of base and module modification features with basic model related characteristics are defined by course modeling experts. In this context, base and module modification feature types are frames, final content of which are defined in feature instances.

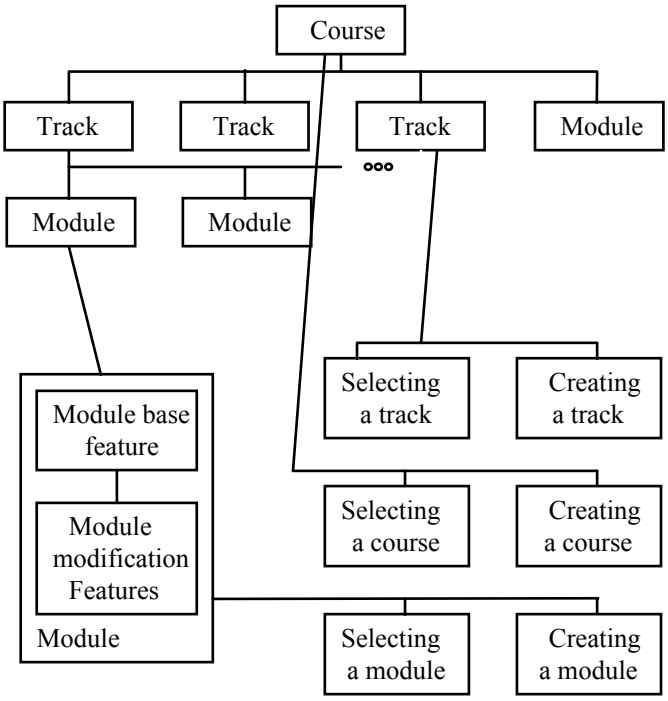


Figure 5
Construction of feature based course models

Virtual classroom procedures handle data structures for models and some auxiliary information. They are supervised by system management (Fig. 6) and are under control of accreditation in close connection with quality assurance. Teachers utilize system management and quality assurance tools at virtual classroom procedures. They define virtual classroom resources and control teaching and learning procedures. Students use special purpose browsers and application server software for data base management, multimedia and other functions. They use Internet services to outside connections including remote teacher workstations.

In [3] the authors propose virtual classroom modeling extension (VCME). This allows for implementation of virtual classroom modeling procedures as an extension to one of the advanced distance education and Internet portal software products.

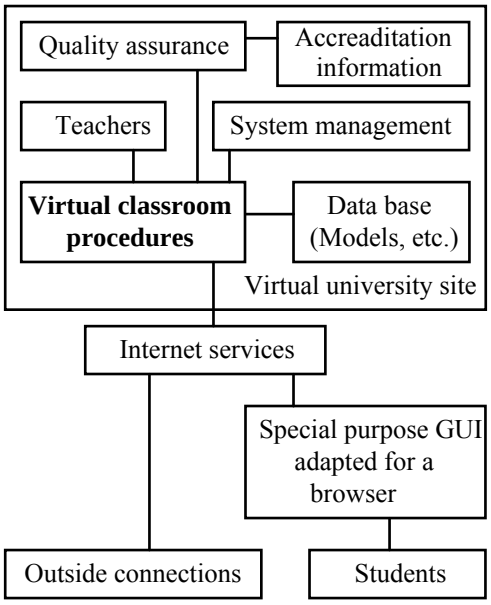


Figure 6
Virtual classroom procedures

## Conclusions

Recent style of learning, both in campuses and further education of practicing people require more versatile and flexible higher education. Internet and advancements in virtual systems together with recent advancements of information technology offer the technology for development and implementation of virtual courses in distance education, campus based education, and mainly in a mix of these basic forms of education. In this paper, some details of a virtual classroom are discussed considering the strong theoretical and methodological basics offered by an earlier published concept and methodology. Virtual

classroom is composed by several groups of entities, as well as procedures controlled by managers. The most important entities are components of virtual courses as tracks, modules, blocks, topics and elements of topics. Generic and feature modeling techniques represent recent achievements in modeling. These techniques are applied to give the required characteristics of classroom models and modeling procedures.

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