The Virtual Global University
The Realization of a fully Virtual University – Concept and Experiences

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Abstract:

Corporate and academic institutions have realized the importance of distributing their knowledge and learning units with the help of E-Learning, leveraging the institution's potential through better educated and trained users.

The "Virtual Global University (VGU)" is an academic E-Learning solution bringing together the experiences and knowledge of renowned German, Swiss and Austrian universities, resulting in a post-graduate degree called "Master of Business Informatics (MBI)". Unlike ICT-supported on-campus studies, the VGU is a fully virtual university providing all administrative, educational and communicational means via an online portal.

The paper features two topics: the first topic is concerned with experiences after the first year of VGU, focusing on the courses provided by the "University of Vienna". Second, the concept for a flexible realization of unit-based E-Learning courses with the help of process-oriented modeling tool ADVISOR® is presented. ADVISOR® aims to transform the modeled E-Learning units into E-Learning platforms, like WebCT, automatically.

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1 General information and definitions

Corporate and academic institutions have realized the importance of distributing their knowledge and learning units with the help of E-Learning, leveraging the institution's potential through better educated and trained users.

The "Virtual Global University (VGU)" is an academic E-Learning solution bringing together the experiences and knowledge of renowned German, Swiss and Austrian universities, resulting in a post-graduate degree called "Master of Business Informatics (MBI)". Unlike ICT-supported on-campus studies, the VGU is a fully virtual university providing all administrative, educational and communicational means via an online portal. The VGU and its MBI are developed under the grant of the German Federal Ministry for Education and Research within the program "New media in education" [1].

Participating universities are [2]

- Europe University Viadrina
- Technical University of Berlin
- University of Essen
- University of Karlsruhe
- University of Berne
- University of St. Gallen HSG
- University of Vienna

and many more.

1.1 Description of existing courses

In order to achieve the academic degree at the VGU, a series of courses, a thesis and practical experiences have to be completed by the students according to a curriculum.

Within the VGU, the University of Vienna provides two courses:

- an elective course, "Business Intelligence"
- an obligatory course, "Process Modelling" ("Process Modelling" is provided in cooperation with the Technical University of Berlin).

The course "Business Intelligence" comprises an introduction to Intelligent Information Processing and Knowledge Processing. Furthermore, selected aspects of Business Intelligence, E-Business Intelligence and relevant parts of Knowledge Management are taught. Both general Business Intelligence technologies and technologies related to Business Intelligence, like Online Analytical Processing (OLAP) or Data Mining, are introduced. Each topic is discussed theoretically first and is then deepened by practical examples using Business Intelligence tools.

The course “Process Modelling” deals with the effectiveness of business processes, which is of major interest in today's business world. This trend is fuelled by the emergence of E-Business as a new means to reach all external and internal partners of an enterprise. Business processes have to be engineered, or re-engineered, to realize the potentials of internet technologies. The “Process Modelling” course recognizes this situation and introduces different methods for capturing, modeling and analyzing business processes of an enterprise in a systematic way. Furthermore, students get to know procedures and project management methods, that support their practical analyzing skills in complex enterprise situations. The course also investigates many current practical application areas of business process modeling, like Workflow Management, E-Business and Supply Chain Management. By providing access to a terminal server at the University of Vienna, students have the chance to use the process modeling tool ADONIS® [7]. The use of this tool reinforces the theory through practical examples.

1.2 Technical realization at VGU

VGU has chosen a “Learning Management System (LMS)” to reach its E-Goals.

There are several definitions for an LMS, summarized in the following enumeration:

- “LMS [...] is a suite of functionalities to deliver, track, report and manage learning content, student progress and student interaction.” [3]
- LMS includes “administrative functionalities supporting registration, application, profiling, personalization and recording of data.”[4]
- “Software that automates the administration of training events. The LMS registers users, tracks courses in a catalogue, and records data from learners; it also provides reports to management. An LMS is typically designed to handle courses by multiple publishers and providers. It usually doesn't include its own authoring capabilities; instead, it focuses on managing courses created by a variety of other sources [...] A software application that allows trainers and training directors to manage both the administrative and content-related functions of training. An LCMS combines the course management capabilities of an LMS (learning management system) with the content creation and storage capabilities of a CMS (content management system).” [5]
- “We're in the midst of an E-Learning revolution, which brings with it rapid change [...] Stage 1: Generic content libraries [...], Stage 2: Learning Management Systems [...], Stage 3: Outsourced E-Learning platforms [...], Stage 4: Learning Content Management Systems [...]” [6]

The following figure shows, how an LMS-architecture has to look like in order to fulfill the required services in a virtual university:

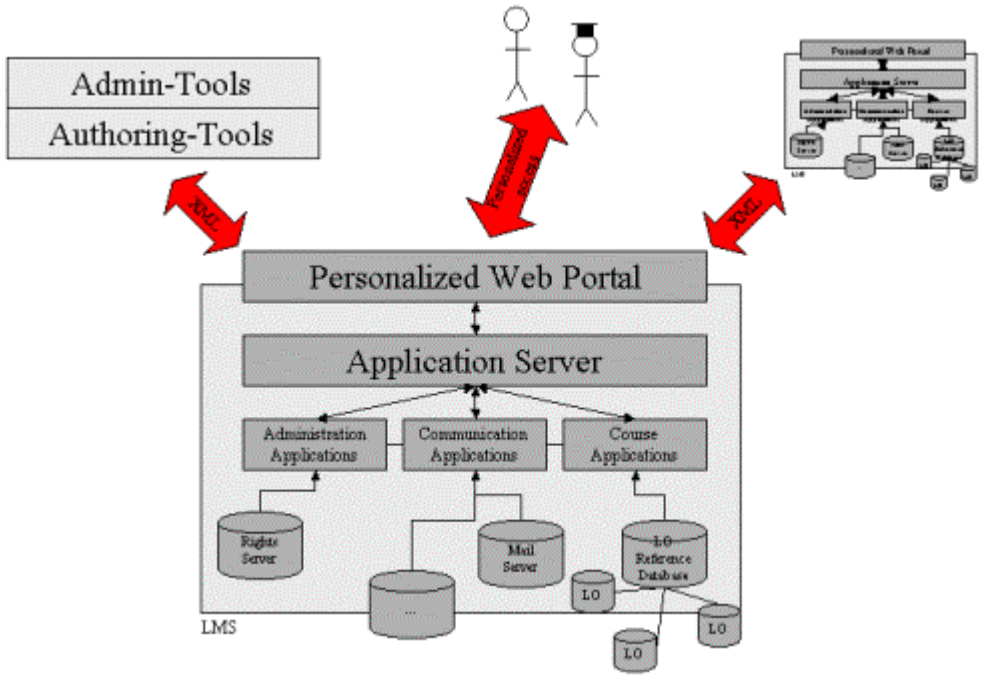

figure 1: LMS-architecture

The arrows connecting tools and web portals in figure 1 show interfaces between several participating entities in the VGU. For these purposes, WebCT [12] (version 3.6) was chosen to serve as an LMS. According to the LMS-definitions cited above, WebCT provides the following functions and tools:

- Access control to courses
- Provision of course materials
- Management of course materials
- Communication tools (e-mail, discussion forum, whiteboard and chat)
- Self-tests for self evaluation
- Automatically graded online tests for learning success control
- Search engine
- Glossary

In the following chapter, the use of WebCT as administration and course building tool within the VGU (chapter "VGU experiences ") is looked at in more detail. Chapter "ADVISOR® " deals with the process-based tool ADVISOR®, that serves as a course modeling engine. Chapter "Future outlook " concludes with a possible interrelation between VGU using WebCT and ADVISOR® as added value.

2 VGU experiences

During the first year of virtual study at the VGU, students, course designers and administrators had to face different situations and challenges by using WebCT, that yield into general requirements for an LMS.

In the following, these experiences are listed, grouped by type of user, because access, management and usage of WebCT has specific functions for each of these groups.

2.1 WebCT experiences

Generally speaking, WebCT meets the basic requirements of an LMS. Courses, students and additional content can be managed, and the goal of providing and teaching content virtually to students is achieved.

Despite its wide-spread use in Anglo-Saxon regions, WebCT still is in an early stage of development, considering especially group work support and sophisticated communication methods.

2.1.1 Administrators and course designers

The experiences the administrators and course designers made with WebCT are two edged. On the one hand, WebCT is a very stable tool, that can be easily overlooked, on the other hand the content provision and management are very laborious.

- Advantages
  - Stable system
  - Easy handling
  - Intuitive usage
- Disadvantages
  - Resource management is time intensive due to non-optimized processes

- No role-based access for effective course management
- No interface to access external mail
- Problems when referencing to external sources
- Basic WebCT installation only processes the document-type html
- Only restricted customizing for course designers possible

2.1.2 Students

Students were mostly missing communication and administrative possibilities. Communication, although chat is provided, lacks an awareness function, so it is impossible to set up chats spontaneously. Furthermore, even if a central point of access with course independent functions exists, it also has to be improved. It misses an external or a central mail account for all the student's courses and a central, course independent site, where official notes regarding the whole study can be announced and a "public cafeteria" for informal discussions among all students can be established.

The administrative functions of WebCT are also insufficient, because students were missing an obvious tracking of their courses, i.e. which parts have already been visited, which parts are still to come, what is the exact current situation of their grades and how will the final grading be done.

- Advantages
  - Stable system
  - Personalized web access to learning resources
- Disadvantages
  - Central point of access existing, but without respect to other services (e-mail, Newsgroup, Calendar, etc.)
  - No instant messaging functionality provided
  - Page tracking insufficient
  - Poor social interaction possibilities

2.2 From experiences to requirements

Based on the experiences made during one year of deployment [1] of WebCT at VGU, requirements, that an LMS has to fulfill, can be derived. According to the structure suggested in chapter "WebCT experiences ", there are also two main categories of requirements:

- Category "administrators and course designers"
- Category "students"

Each of these two categories is further divided into the following sub-categories:

- Usability requirements
- Technical and technological requirements
- Administrative requirements
- Communication requirements

2.2.1 Administrators and course designers

These requirements lead us to the point of view of administrators and course designers regarding an LMS in general.

2.2.1.1 Usability requirements

The usability requirements from the administrators' or course designers' point of view focus on administration and easy handling and provision of material, the so-called authoring. They are:

- Existence of course templates for course authoring
- User interface for course planning, managing and monitoring, support for fast revision of courses
- Built-in file management tools
- Ability to export/import data
- Standard interfaces to external resources
- No programming skills required
- Built-in instructor and student manuals

2.2.1.2 Technical and technological requirements

The main technical requirement for an LMS is the platform independence. Furthermore it should be allowed to transfer any kind of client content format (PDF, MS Word, Real Networks, Macromedia, etc.) into the LMS from external sources. Besides, server side technologies (PHP, ASP, etc.) have to be made accessible.

An important technological requirement is openness towards E-Learning standards (LOM, IMS, SCORM, etc.) for easy integration of existing resources.

Furthermore, quiz and exam authoring has to support content import and authoring for creation and scoring of quizzes/exams (including multiple choice questions, true/false questions, matching questions, short answer questions and essay questions). This is the first step to automated grading.

A supported testing stage for evaluation and debugging of course content before making it available to students is also necessary, in order to provide high quality courses. For quality assurance, the LMS should allow viewing the course (conditional release of content, etc.) and quizzes as a student without logging out as designer.

In brief, technical and technological requirements are:

- Platform and technology independence

· Standards compliance

- Students evaluation support
- Quality assurance

2.2.1.3 Administrative requirements

Administrative requirements deal with the management of participating human and technical resources.

- Progress tracking

- Resource monitoring
- Ubiquitous administration access
- Security features like login and logout

2.2.1.4 Communication requirements

Communication requirements focus on exchanging messages throughout the LMS, connecting administrators, course designers and students. Functioning communication is the foundation of E-Learning courses and therefore needs to be simple but powerful. Requirements are:

- Sophisticated and intuitive interfaces for communication clients
- Access to external e-mail
- Word-processor-like ability to format text messages.

2.2.2 Students

Whereas administrators and course designers primarily need to manage resources and students, students' requirements deal with the use of the LMS and its content and especially with fast and effective communication.

2.2.2.1 Usability requirements

The usability requirements from the students' point of view focus on easy handling of courses, tests and exams.

These requirements mainly focus on information providing:

- Automated news-update services
- Public information areas
- Contact information areas
- General calendar for all courses
- Course-specific view of calendar
- Interface to resources like literature (books to buy) or glossary
- Bookmark management
- Search tool for course content

- Resume session function

2.2.2.2 Technical and technological requirements

The technical and technological requirements on the students' side have not got the same relevance as for administrators and course designers, because students have limited writing access.

The requirements are:

- Support of commonly used internet components
- Built-in file management tools
- Ability to organize documents over time (versioning)
- Bandwidth friendly
- Online assistance
- Client-side multimedia support
- Project areas (independent from courses)

2.2.2.3 Administrative requirements

The administrative requirements from the students' point of view mainly focus on success control during the courses:

- Authentication
- Self-assessment
- Progress tracking (i.e. task management, submission deadlines, etc.)
- Student access to own grades
- Availability and visibility of new lectures/assignments/assistants/professors

2.2.2.4 Communication requirements

Communication requirements for students differ only slightly from the ones for administrators and course designers. The experiences of the first year of VGU show, that implementing these requirements in a meaningful way will improve course quality noticeably.

- Ability to communicate publicly or privately with other students, administrators or course designers
- Sophisticated and centralized e-mail (support of mailing lists, etc.)
- Sophisticated and centralized discussion forum (threaded discussion, support of groups, etc.)
- General address book for all courses
- General discussion/question area
- Chat rooms with logged chats and awareness function
- Whiteboards
- Bulletin board/conference systems
- Student presentation area

3 ADVISOR®

ADVISOR® is a technology, based on the meta-modeling tool ADONIS® [7] and is a set of model-types to describe E-Learning courses. The tool ADVISOR® together with the ADVISOR® methodology, based on the Business Process Management Systems (BPMS) methodology [8], form a holistic approach towards E-Learning.

The underlying idea of ADVISOR® is the use of modular units, called Learning Objects. Depending on the origin, several definitions and names for these modular units exist:

- IEEE/LTSC [9]: “A Learning Object is defined as any entity, digital or non-digital, that may be used for learning, education or training.”
- Koper [10]: a “unit of study [...] is the smallest unit providing learning events for learners.”
- McGreal [11]: “A Learning Object can be any entity, digital or non-digital, that can be used or referenced in technology-supported learning. A Learning Object can be physical, such as text, a workbook, or a CD-ROM, or online, such as electronic text, a .GIF graphic image, a QuickTime movie, or a Java applet.”

Learning Objects in ADVISOR® can be combined and linked via model-type-referencing. Implicitly, this modular structure has several advantages:

- Possible convergence with E-Learning standards, i.e. IEEE/LTSC LOM [9]
- The creation of small, modular Learning Objects makes it easier to re-use them, especially in terms of learning-on-demand.
- Modular Learning Objects, in terms of skill-management, are much easier to assign to a person. A personalized curriculum showing the current skills may be the result and could show the learning gap, the person has to overcome in order to achieve a certain knowledge standard.
- E-Learning is often mixed up with teleconferencing and delivering the content with large video-streams. This is a contradiction to modular Learning Objects and metadata per se. Moreover, students will not cope with long videos, because interactivity and communication is very limited.

3.1 General description

Generally, ADVISOR® is based on the idea of Business-Process-Management (BPM) and can be introduced as a professional management tool for the design and optimization of training processes and for the management of training materials.

By adapting the process-idea for E-Learning, BPM advantages are inherited and totally new perspectives are gained, since modeling with ADVISOR® is nothing but describing metadata of Learning Objects. Instantiating these meta-models shall result in E-Learning standard-compliant XML code, that can be used universally.

The ADVISOR® methodology comprises several steps, including analysis, production of training material, distribution and quality assurance as shown in figure 2 .

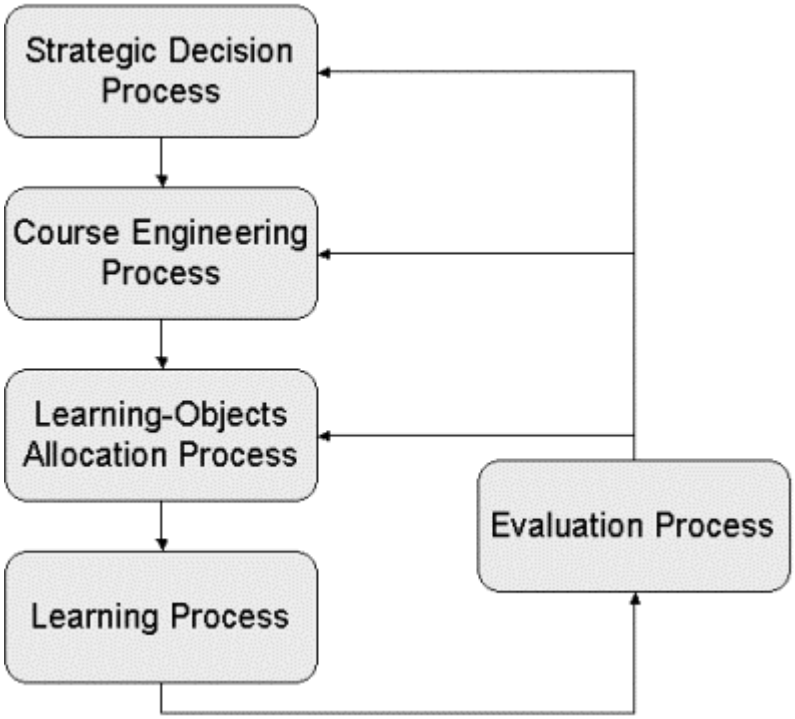

figure 2: ADVISOR® methodology

The “Strategic Decision Process” covers long-term decisions and planning concerning the linkage between the core business and the E-Learning processes, learning technologies and possible LMS. “Course Engineering Process” and “Learning-Objects Allocation Process” cover all modeling aspects and can be compared to engineering business processes in BPM. The latter two will be described in the following chapter “Model types ”. The “Learning Process” takes the models and instantiates them at Run-Time. The utilization at Run-Time produces log-files and other data that is input to the “Evaluation Process”, where the interpretation of measures define further actions.

3.2 Model types

“Course Engineering Process” and “Learning-Objects Allocation Process” both need to use the ADVISOR® tool in order to create models. ADVISOR®’s methods include the following E-learning model types:

- Training Map
- Training Sequence Model
- Media Library
- Working Environment

The model-interrelation and linking is quite important, and is made up out of the following levels shown in figure 3 , where, originating from a conceptual “Course Framework”, the model granularity increases towards the “Execution Level”.

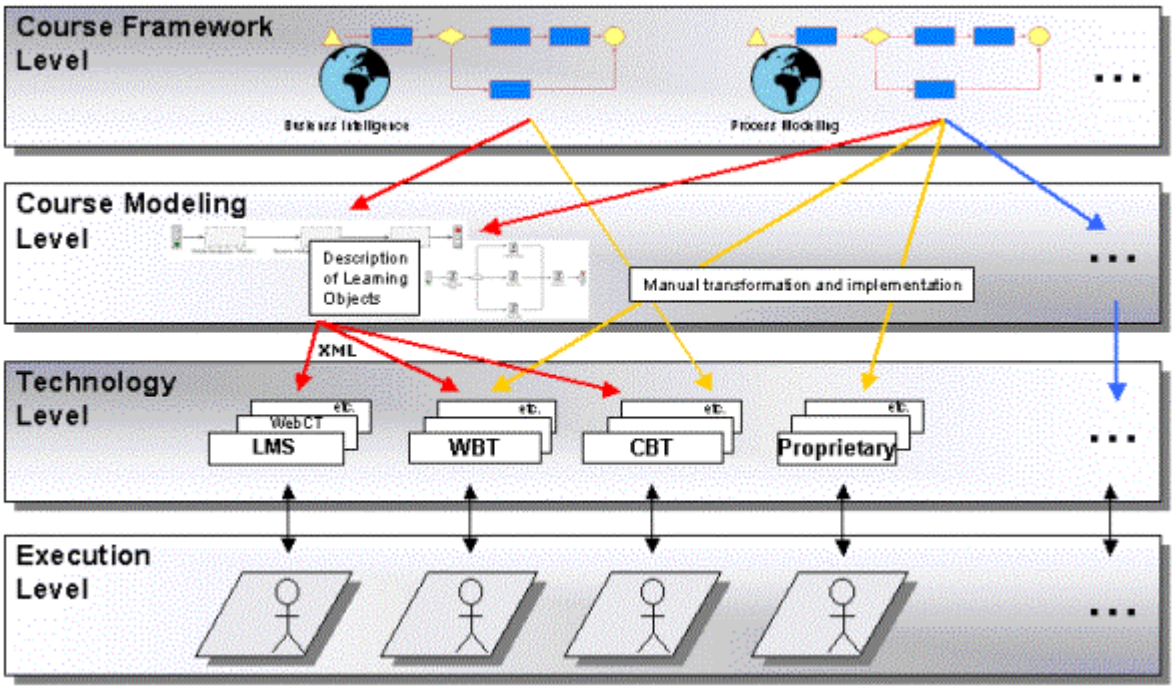

figure 3: Modeling layers

Detailed description of the activity “Course Engineering” will be provided by the E-Learning models “Training Map”, “Training Sequence Model” and “Media Library” according to the methodology’s steps “Course Engineering Process” and “Learning-Objects Allocation Process”. The course engineering starts with a “Training Map”, a macro-view on the E-Learning landscape. All courses are placed on the modeling canvas, showing possible interrelations, if existing, shown in figure 4 .

figure 4: Training Map

Going into further detail by clicking on a course icon in figure 4 , the “Training Sequence Model” shows the course units as ordered events, as depicted in figure 5 .

figure 5: Training Sequence Model 1

Each module can then be described on a more detailed level by linking a course unit with another “Training Sequence Model” that shows the ordering of Learning Objects within this course unit (figure 6).

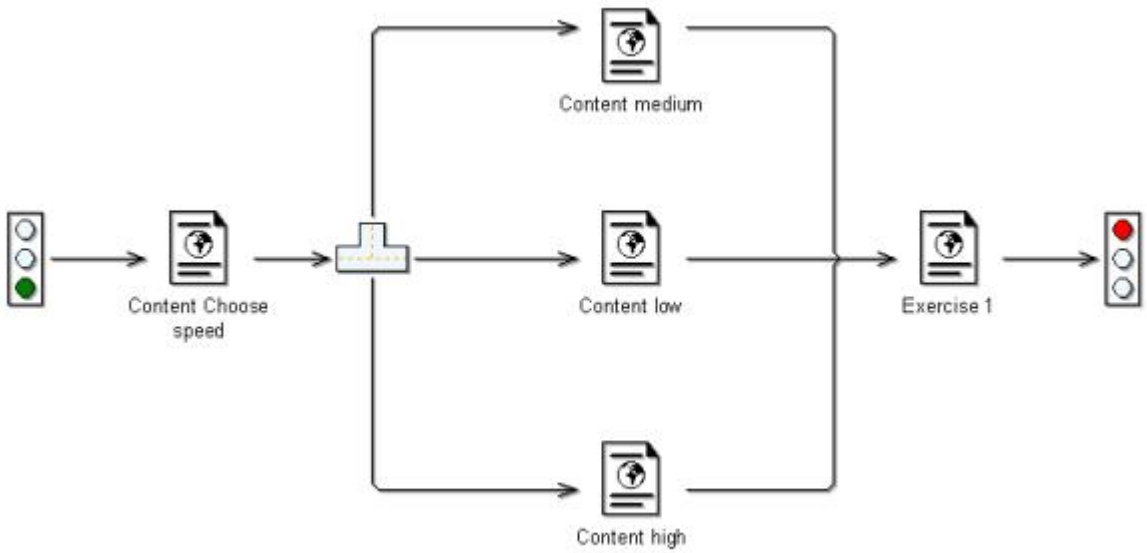

figure 6: Training Sequence Model 2

As a last step, on the most atomic level, a Learning Object itself is described in the “Media Library”, as shown in figure 7 .

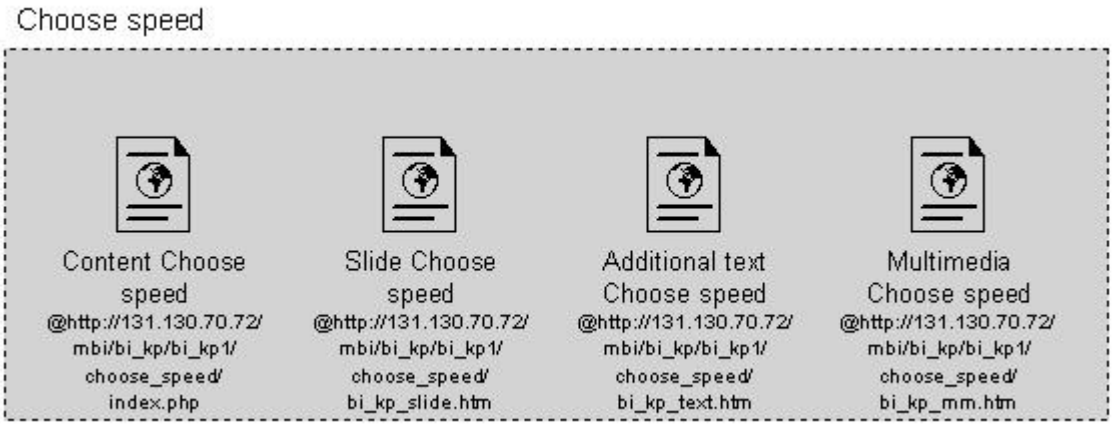

figure 7 : Media Library

3.3 Integration of Learning Objects with ADVISOR®

The modeling character of ADVISOR® and the possibility to describe Learning Objects as modular units bring advantages that were already mentioned. As the final step, ADVISOR® models need to be mapped to standard compliant XML-files, so that the interface to LMS is defined and ADVISOR® takes the role of this mediator, as shown in figure 8 .

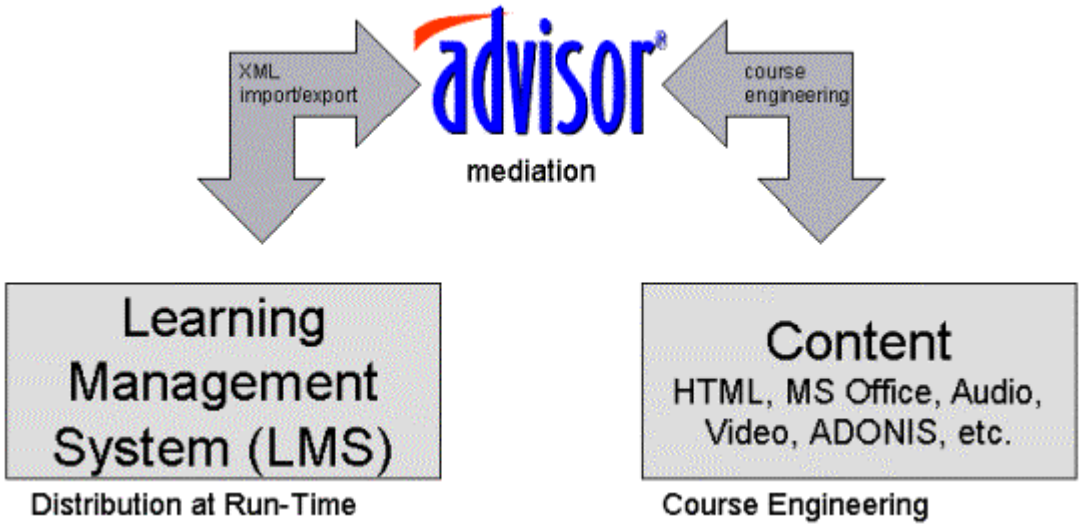

figure 8: ADVISOR® mediation

For successful customization of ADVISOR® in this context, requirements definitions and scrutinizing standardization issues (IEEE/LTSC LOM, IMS, SCORM) are the key .

4 Future outlook

Today's E-Learning tools miss sophisticated capabilities to administer Learning Objects and further resources. An LMS used stand-alone seems not to be the right choice at this point.

ADVISOR® is able to fill this gap, if requirements are transformed correctly.

The following bold-faced requirements (see chapter "From experiences to requirements "), therefore need to be considered very closely in ADVISOR®:

- Administrators and course designers
  - Usability requirements
  - **Technical and technological requirements**
  - **Administrative requirements**
  - Communication requirements

Next steps in ADVISOR® include the implementation of these requirements. The emphasis lies on the creation of E-Learning standards compliant ADVISOR®-models, that serve as mediation means to LMS.

Only the combined use of an LMS and ADVISOR® guarantees satisfaction for all participants.

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[1] The requirements are based on students' feedback, revised and completed by the authors and focus especially on the specific scenario encountered at VGU using WebCT.