

Multimedia Learning Environment: Combining easier courseware production and new learning methods

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In this paper important facts that should be considered when using web based courseware in education are examined and an overview of important existing systems is given.

Considering these experiences we have developed the prototype of an integrated General Networked Training and Learning Environment (GENTLE). The main features of GENTLE such as simplicity of usage, integration of new learning- and courseware creation methods are described in the main part of this paper.

1. Introduction

The field of computer assisted learning has reached a new high in popularity due to the Web. A variety of different products trying to meet the needs and supporting of Web Based Training (WBT) exists. In contrast to the traditional classroom equipped with the blackboard and a piece of chalk (and perhaps a projector for transparencies) there is the electronic world with its challenges like virtual universities or virtual classrooms. And there is more and more courseware on the Web.

The main question is how to develop computer-based learning materials (courseware). The classical Computer Assisted Learning (CAL) approach is primarily presentation based, with a hierarchically structured domain of topics and sub-topics. In the literature [2][13][21][22][23][26][32] many scientists have explained the disadvantages of early attempts like e.g. that the courseware is strictly bounded by subject matters and the presentation techniques make it difficult to alter the content of the courseware. Disadvantageous is also the fact that many question – answer dialogues must be

pre-programmed. This is not only a very time consuming task, it is an impossible task. How can anyone foresee all possible questions? Further, questions may vary considerably from audience to audience.

Just introducing technology into teaching and learning does not make them more effective and more efficient. The technology must be used as a cognitive tool to facilitate creativity, problem-solving, analysis and evaluation. Cognitive tools are technologies that enhance our thinking, problem-solving and learning [5][29][32]. When computer applications are used as cognitive tools, students use software to analyse problems and tasks to organise unique knowledge representations and share what they have learned with others. For this learners need interpersonal communication, the opportunity to ask questions and ways to discuss problems with tutors and co-learners. The learning context should include the following roles where the students may find themselves in each of them within a single working day [2]: working alone (interacting with learning material), working collaboratively with colleagues, working with a more experienced colleague, supervisor or instructor, working as an instructor for less experienced colleagues.

The requirements for the new generation courseware are [13][21][22][30]:

- *Modular design* enabling the instructors to change the content and the sequence of learning to meet the special needs or to fit new contexts.
- *To overcome the learners passive role* by enabling a dialogue with an instructor or among learners.
- Most important, courseware creation environments (learning environments) have to be *user friendly* supporting the instructor to create the courseware without programming skills and giving structuring assistance for the subject.
- To overcome the “tunnel syndrome” digital background libraries have to be supplied in addition to communication facilities.
- Learners must be able to annotate, link together and structure existing material, and must be able to include own contributions.

2. Overview of some existing systems

Market surveys indicated already in the 1994 that the second largest category of demand from potential users of wide spread telecommunication services will be for education and training (surpassing even films and TV) [2]. Therefore producers need a clear vision of what kind of

education and training systems are needed in the future, combining the possibilities of technology and the needs of the educators.

The main idea of JIT (Just in Time) education is that everyone should be able to access the education and training that they want, when and where they need it. This implies that high quality education and training should be available on demand in the home, the workplace, at educational or training institutions or even when travelling. With new possibilities of learning through the Web or also local networks, learning and training costs may be reduced and valuable information may be shared in a continuous learning process.

Some of the common uses of the Web for educational purposes as follows [30][23][26]: enriching access to course material, documenting course discussions, posting student writings for critique, providing tutorials, simulations, drills, facilitating group work, enabling reflection and meta-cognition.

2.1. Home

Home is a new environment for distributed hypermedia, providing access to WWW clients [4]. It is based on the client-server architecture and on a layered approach. Raw data, multimedia characteristics and hypermedia structures are separately stored in different layers. The separation of raw and meta-data is motivated by their different characteristics (raw data are time-dependent and not well structured). The data structure of the hypermedia layer, based on a set-oriented approach, is strongly influenced by the HM data model[21][22]. The basic data structure is a set, identified by its unique name. The set membership does not need to be hierarchical, it can contain loops, meaning that recursive relationship are explicitly allowed.

The Home environment supports: very specifically structured queries (dealing with the problem of information retrieval enabling the exact search criteria definition), access to different Hypermedia Systems, separation of structure and content, enabling modification and still providing document integrity, bi-directional links (removing dangling references), back-link capability (creation of local overview maps), different views of the same content.

2.2. TopClass (by WBTSYSTEMS)

TopClass technology is based on the open and non-proprietary standards of the Web, taking the advantage of using the Web in training and education [31]. It provides a virtual classroom environment for distance and distributed education. Because the TopClass integrated environment requires more than a simple Web server, the TopClass server contains its own embedded object-

oriented data-base where all information about users and classes (including contents) are stored. The object-oriented architectures provides the flexibility, dynamism and extensibility which is required by a learning environment.

Courses are composed of Units of Learning Material (ULM), which can consist of pages, exercises and other ULMs. The material is structured hierarchically. The ULM structure supports breaking up the materials into modules.

The paradigm introduced by WBTSystems, is „guided learning“, a combination of classroom-based learning and computer based training aspects, based on three fundamental ideas:

- an *integrated learning environment*, providing the access to course contents and supporting the student – teacher and team collaboration,
- *content management* supporting the authors by structuring and creating courses, emphasising the modular design, reusability and redundancy,
- *class management*, meaning the progress monitoring and management of students with all necessary security features.

There is the possibility to personalise the courseware by modifying the material for individual students without affecting others in the class. Based on test scores (graded by the instructor or automatically by the server) the server can take actions such as automatically assigning additional course material or notifying the instructor about the student scores.

2.3. WebCT (World-Wide-Web Course Tools)

WebCT is a tool that allows the creation of Web-based educational courses [28]. It contains educational tools that can be incorporated into any course and provides tools for assisting the course administration. The WebCT courses come in form of the HTML pages, created with any HTML editor or conversion program. With the help of WebCT the course designer is able to add to the pages interactivity, structure and educational tools.

There are three main aspects of the WebCT:

- a *presentation tool* allowing to determine the layout, colours, text, numbering and such for the course pages,
- a set of *student tools* that can be integrated into any course; this includes student evaluation and self-evaluation tools, image archives, course calendar tool, a linkable glossary database, student collaboration and presentation areas,

- a set of *administrative tools* for aiding the delivery of a course and enabling the teacher to track the students progress; these tools also allows course access tracking, questionnaire delivery and report generation, grade maintenance etc..

A course created with WebCT is organised around one main homepage which is the entry point for the course. The home page contains, among the other things, the links to course tools and supplementary homepages, called toolpages. Toolpages can have the same structure as the home page: the only difference is that they are accessible only from the main home page. The course designer interface helps to structure the course pages in a hierarchical way, edit the path, add built-in images which can be used in any course. The incorporation of student tools is made simply by placing the icon, representing the desired tool, on a button-bar. With tools like course bulletin-board or conferencing system, electronic mail and chat tool, group work and communication between the course participants and the teacher is supported. With the help of the chat tool real-time tutorial sessions may be held on-line by teachers or instructors.

Interesting support of student evaluation and self-evaluation are timed on-line quizzes written by the course authors. Five different question types are supported: true / false, multiple choice, matching, fill in the blank, short answer. The quizzes may be marked manually or automatically. After marking the students have the access to the quizzes, comments and correct answers.

2.4. Virtual-U

Virtual-U is a server-based multimedia software system composed of an integrated set of software tools and templates enabling customised design, delivery and enhancement of education and training courses delivered over the WWW [5]. Virtual-U is also designed to enable and facilitate asynchronous discussions, collaborative learning and knowledge building.

It has the following components:

- *VGroups Conferencing System* is a collection of conferences and messages, where participants communicate using a newsgroup style, being able to switch between different conferences and playing different roles in different conferences.
- *Course Structure Tools* enables teachers to put courses online, without knowing HTML and provides the access to course structure and included online resources for students.
- *Gradebook* is a tool for grading courses and putting the results online. It assists also in analysing and monitoring the results of the whole class and / or individual students.
- *Submission Box Manager* is an interface for processing submitted assignments in electronic form and for evaluating and commenting the assignments by instructors.

- *Course Space Manager* is an interface for uploading and commenting uploaded files and managing the size for a course space and/or an uploaded file.
- *System Administration Tools* is a set of tools for managing the course- and user databases, updating user information, setting instructor and students IDs and passwords.
- *Online Help and Support* is divided into online available documents (Release Notes, FAQ-page, assistance pages, links to other resources) and Email/voice interactive support.

Course design support consists of guidelines for delivering learning outcomes, instructional techniques, evaluating learning outcomes and supporting group- and activity design. Each course is structured into chronological units, consisting of a topic and description, links to VGroups conferences, description of course resources with optional URLs, description of graded and non-graded activities. There is also the user support to share their own tips and experiences with other users.

The emphasis in Virtual-U is mainly on team work, supporting discussions and discussion groups, class management and evaluation with the help of the on-line grade book, enabling students to see their own grades (compared to the class distribution of grades) or to read the teachers' remarks concerning their working progress.

3. GENTLE - General Networked Teaching and Learning Environment

This system is currently under development at the Institute for Information Processing and Computer Supported New Media (IICM) at Graz University of Technology and the Austrian Web Application Centre (AWAC) and tries to achieve maximum benefit through new learning and teaching methods and tools, and simplicity of usage, for both the trainers as well as the students.

On the teachers' side the key aspect for the acceptance of the system is a *gentle* approach to web based training. This means that GENTLE supports a soft migration of courses from the traditional lecture room style, over electronically assisted courses to fully featured pure virtual Web based lectures where no physical co-presence of students and teachers is required any more. Courseware creation and reuse is supported by various so called wizards, managers and tools that take over routine tasks and provide guidance at more sophisticated undertakings, using helpful user interfaces. In addition, GENTLE is also an administration system, managing students records (exercise assignments, grades, learning progress etc.) classes (who may or has to participate in a course etc.) and for keeping statistics about courses (quality, efficiency, acceptance, etc.).

The benefit for the students are an integrated learning environment with common features independent of course content and style, including tools for asynchronous and synchronous communication and collaboration, search in a background library, progress indicators monitoring the learning success etc.. The environment also serves as an administration utility for the students to help them planning their career. It is also conceivable that the system automatically suggests certain courses depending on the students talent (which can be determined by examining previous grades and courses taken) and also predicts what career path could be completed within what time (assuming continuing success and ambition).

In addition to above features concerning the courseware material it is also planned to support different students characteristics, like learner type, knowledge and cultural background and skill levels (e.g. different grades of detail); different network bandwidths (by offering several qualities of the same material, like text, image, audio and video) and different presentation types, depending on the way the lecture is held (e.g. slides with animations for a life demo, or more detailed explanations including audio etc. for web based training). Each of these different materials has to be kept within the same course structure and it has to be possible to switch between these types whenever suitable (e.g. switching between material optimised for the visual learner type and another one, to let the students find out the type most suitable for them).

The system is based on Hyperwave [9][10][10][17] and requires only a Java and JavaScript capable browser such as Netscape or Internet Explorer on the client side (both for trainers and trainees).

3.1. GENTLE wizards and tools for the trainers

Currently the following wizards are under development:

- Course wizard
- Module Manager
- Page Wizard

The course wizard is the main tool for a trainer to create a new course. Upon launching it will interview the teachers about their intentions concerning the course content and style (e.g. title of course, course objectives, requirements, table of contents, short abstract, information about the trainer and tutors etc.). This is done to ensure at least some basic information on each course and a certain courseware quality. After answering the question the wizard will create a course skeleton including a basic structure and the complete courseware environment (described later). If the teachers would decide not to invest more work into the generation of the course they may finish at this point and use it as a support for traditionally held lectures. It would then appear in the list of available courses and may be subscribed by students. Whenever students register for the course the teacher (who created the course) will be notified (if wanted) and may use the student administration

facility of the system to manage the class, assign and monitor grades etc. Although the students don't have any courseware content available in this case they still may profit from the course environment which provides them with communication, collaboration and information features.

If authors decide to use all features of the system they may now use the page wizard and the module manager to create new course contents. The page wizard is primarily used to produce new and modify old pages and sections. An author may choose from different tools, layouts and types (e.g. HTML documents combined with HM-card animations or Flash plug-ins) and may add different attributes (like keywords and access rights) and behaviours (e.g. document only shown when a special quality/network bandwidth has been selected, or if a special learner type has been selected). It may also be used to assign new books to the background library.

The module manager is used to group several pieces or pages together to a module, assign several keywords to it and to store it in the *module repository*, so that it may be reused later on. In the future it is also planned to support trading of modules for large module repositories using the Hyperwave billing mechanisms, so that own modules can be sold or modules created by other authors can be bought or exchanged with own creations.

The administration and statistic tools fall in a different category: their main purpose is to keep an overview of the students' progress and courseware quality and acceptance (producing statistics on average questions asked on a certain page, average reading duration, error rate in exam answers, etc.). They are also used to control access to courses (e.g. the access to a page might not be granted to a student, or it might be defined under which conditions and requirements a course will be automatically suggested for some students, etc.) and assign working teams for collaboration (getting shared workspace and chat rooms for doing exercises together, or preparing for an exam).

3.2. The course environment and other benefits for the students

When the students log into the WBT system they get access to their personal locker. This is their main entry point. Here are listed what courses the system suggests the students to do next, the courses currently enrolled and the courses already taken. Further students may access the private or shared workspace and the students personal characteristics (like name, student id, grades, progress statistics etc.) If a student enters a currently enrolled course by clicking on it, the course environment will become visible. Currently it provides access to the courseware content (hierarchically structured), general information (like course objectives, table of contents, requirements, information about the teacher, previous exams etc.) and announcements (like when the next exam takes place etc.). Here the students may also access the asynchronous and synchronous communication and collaboration features: For example a student may mark a certain

phrase on a page and add an annotation of type “question” which results in a notification (currently a simple email generated by the system) to the tutor or teacher. Several annotation types (remark, pro, contra, question, answer, ...) documents types (not only text) and access rights (private, public, group) are supported. This annotation may also be the starting point of a threaded discussion in the discussion forum. The synchronous chat facility (also supporting different document type and features like shared whiteboard etc.) may be used for e.g. official office hours to talk with the teacher (such a talk might be recorded for later reuse to build a knowledge base) or to meet in learning groups and (virtual) rooms.

The context related background library can also be accessed from the course environment using either various sophisticated search functions or by directly browsing through it.

Alternatively the whole course system might be downloaded locally or pressed on a CDROM to be used offline.

3.3. Current status and the future

A prototype of GENTLE has been already tested in one of our courses in a semi virtual mode (as support of a traditionally held course, as well as with full courseware content) with great success. The main purpose of this was to gain feedback (supported by questionnaires and virtual discussions) from students in an early stage of development. We are now planning to use the system in more courses and also integrate other teachers to get feedback from authors that are new to the system. The next stage will be to test the system in non university areas like adult classes and in companies employee training programs. The most challenging task will be to simplify the user interface so that even very computer illiterate users can handle and understand it quite quickly. We are planning to finish most parts of our development within the next two years. Further information about the project can be found in [27][26][23][18][23].

4. Conclusion

Based on the experiences of already existing systems and the facts found in literature we implemented the foundation for our learning environment. This learning environment will hopefully be extremely user friendly (for teachers and students), will support the reuse of existing material and focuses on good communicational facilities and team work.

5. Literature

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