

GENTLE - (General Networked Training and Learning Environment)

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Abstract: This paper describes a web based training system which has been used as a working prototype to assist teachers in lecturing since fall 1997. The main goal of this system is to provide an integrated environment for both students and trainers. Lecturers can use it to create, maintain and offer courses and also administrate student affairs. Rich communication facilities extend the advantages the system provides to students. Apart from university areas the system is also designed for usage in companies to train its employees.

1. Introduction

Due to faster development cycles in science and industry, life-long learning has become a key factor for everybody who wants to continue being successful in a job - or even in private life. Great efforts have been put in the task to ease knowledge transfer, make it more pleasant, or simply automate it to become more efficient. Over 30 years ago computer based training (CBT) was introduced as a supplement to traditional classroom courses, with these goals in mind.

The advantages have been that students can decide where, when and how fast to learn; a lot more students can be reached; and learning can even become fun (particularly) if a CBT course makes good use of multimedia. The disadvantages are that CBT students often suffer from a 'tunnel syndrome' because they are restricted to material stored on the CD-ROM, and they don't have the possibility of getting answers to any questions that were not foreseen within the original design of the course system. There is essentially no support for communication between students and a teacher or tutor who might help them. Another major disadvantage is that the generation of a good, comprehensive course is *very* expensive.

A possible solution to these problems is a Web based training system that provides good communication facilities and even better reachability, through use of the Internet (or an intranet) combined with powerful tools to generate, maintain, and offer courses. The following documentation concerns such a system, based on Hyperwave [Maurer 96a], called GENTLE (an acronym for 'General Networked Training and Learning Environment') [Maurer & Dietinger 97].

Note: Whenever we speak about the 'Internet', 'students' or a 'campus', this doesn't mean that this system is restricted to university applications. It can also be used effectively within local network systems by companies that want to train their employees!

2. GENTLE knowledge management system

Traditional CBT and even WBT systems have the problem that they not only isolate the students from each other, but also from the courseware authors and course contents they have created. GENTLE provides mechanisms to automatically store and maintain courses; this helps to increase reusability and thus reduce course creation time and cost.

The module repository and the course wizard

Each course, which is stored in a course library, consists of several *course modules* which again are stored in a module repository. Each module is characterized by a set of attributes and keywords to ease re-use when looking for already existing lessons to include in the development of new courses. Courseware authors can decide to physically copy a module and make their own changes to the module afterwards, or they can just link a module to their course (logical copy). In the latter case modifications to the module can only be made by the original module author - not by the author of the course who wants to include the module. The advantage is that any update or changes to a course module, by the module author, are immediately reflected in all courses where this module is included. If wanted the Hyperwave billing mechanism can help in establishing courseware-module markets, in contexts where modules can be sold or exchanged.

The authoring tool that supports the creation and administration of learning modules is called the *course wizard*. It also assists in creating new courses that follow clearly predefined pedagogical guidelines by suggesting a consistent structure.

Each new course includes an introductory page that has to be publicly readable (even if attending the course is not free) and contains the following information:

1. overview/aims/content
2. prerequisite and course level(s)
3. how to use this course
4. time required to master the course
5. references
6. samples/highlights

In the first section an author should give a short abstract about the courses content, its aims and how a student would benefit if completing the course. The prerequisite section has to describe the required knowledge background of the student and the difficulty levels in each case. Alternatively, the system could offer an introductory questionnaire upon course enrollment wherein the existing skills of the student are tested and this information is then used to generate an adaptive *course*, customized to that individual. In the same way, the student's learner type could be taken into account and thus provide a maximum adaptation to the student's individuality. Please note that this does not mean that a special version of the course is created for each student, but that the system dynamically decides upon retrieval which student should get which course page in what way!

In the third section the author can state whether this is a computer-assisted instruction course that supports a traditional lecture, or if it is a true Web-based training course, without physical presence of a teacher. This can also be the right place for including links to the teacher and the supporting staff (possibly automatically generated by the system). In addition, the system automatically creates a link to an 'introduction to the WBT system' lesson (which is included in every course and publicly readable).

Another quite important piece of information is how long the students could reasonably expect to take in completing the course. This of course depends on their own knowledge background and abilities - and thus might be re-adjusted after they have done the first lesson!

'References' is a link to the course's *background library* - including all relevant material that complements the courseware content; like full online books, descriptions of traditional books, or links to other interesting pages on the Web.

The last section could show a few highlights out of the course to whet the appetite, give an overview of the course style or quality, and also work as an advertisement (especially for courses that students have to pay for).

Apart from the introductory page a course also consists of course modules. Each module should address each topic treated, described in a short introductory page within that module, and may include frames and chapters, or subchapters that combine several frames. A frame can be composed of any document type like text plus images, audio, video, animation, simulation, tests or of a mixture of these elements. It is recommended that at the end of each lesson the author should add a self-test for the students, to let them evaluate whether they have understood the content completely. The course should suggest a specified set of frames to redo if necessary. Note that because this test is not used to assign grades, students are given the means to be able to decide for themselves whether or not they have solved a problem correctly. There is no need for 'artificial intelligence' to check answer for correctness.

The course environment

Whenever an author creates a new course using the course wizard, it will also automatically generate a *course environment* that provides the following features:

- navigational aids (table of contents, next/previous frame, last page visited)
- several ways of student/student and student/teacher communication
- systems to support the inclusion of private notes
- search routines for the background library

Due to the features of the Hyperwave server, no extra programming (apart from layout-specific features) is required to provide a table of contents at the beginning of a new chapter, or to update the 'next' and 'previous' frame function. The last page that a learner visited can automatically be accessed on any later occasion, after interrupting a course session, in order to guarantee a smooth continuation of learning.

To reduce the tunnel syndrome, both synchronous communication (like online chat), as well as asynchronous communication (like discussion forums) are supported. Annotations serve a special role in GENTLE. Students can either make private annotations (as personal notes to a special point within a frame) or public annotations of several types. Annotation types are

- comment
- supporting argument
- counter argument
- question to the teacher (private and public), or to other students (public only),
- answer
- teacher 'hints'

Annotations can be created by the students either identified or anonymously, or by the teacher. These types can also be used in the discussion forum and are visualized using different icons. If students have posed new questions to the teachers, those teachers will be notified by an email.

The course environment also provides a powerful search function; with the capability to restrict the search scope, to the background library, the entire course content, or the complete courseware server.

Delivery tools

GENTLE can either be used online, where the students are connected to the server all the time (useful in PC-laboratories or in student residences that have a direct network connection), or offline. For primarily offline use the whole course content, including the background library, can be extracted from the courseware server and put on a CD-ROM. Hyperwave functions like searching are emulated using Java applets, requiring only an ordinary Java-capable Web browser. To prevent the 'tunnel effect', annotations and intermittent links to discussion forums are supported. The students simply have to go online occasionally for a short period of time to synchronize their data with the server and to fetch new answers or annotations. The course environment is slightly different because additional online functions (*synchronize feature*) have to be added, but it generally appears the same to the students either way they use the system.

Course Evaluation tools

Due to the fact that GENTLE is based on the connection-oriented protocol of the Hyperwave server, user-tracking and even student-modeling become possible. This can be used together with pre- and self-tests for improving the overall quality of the courses as well as fitting the personal needs of the students during the dynamic customization process (of adaptive courses).

Students management

Whenever new students enroll at the courseware server, they will have to answer a few questions to inform the system about their knowledge background and their aims. This information can be used to automatically determine what courses (e.g. additional optional subjects) students should take and automatically suggest them. At the university level a customized study plan for each student can be generated. Commercial companies could use this feature to design a career plan for each employee (of course the decision process can be influenced by relevant authorities).

To sum up all the features of GENTLE: It is not only a network-based CBT system, using the Web simply as a transport medium for static courseware, but can be more clearly seen as a dynamic and comprehensive *knowledge management system*.

3. GENTLE from the student's point of view

Although certain features are also available to anonymous users, full benefit can only be granted to identified users. Each new user has to fill out some form to specify at least a few personal details. For a student this could be name, registration number, area of studies, intended outcome, etc. This questionnaire can also be extended to become a so-called *profiler*, where the students answer some test questions to find out their level of background knowledge, learning habits ('learner type' according to Meeker) and cultural background. This information can later be used in the formulation of *adaptive courses* which dynamically adjust their content and style according to the students' profile. In this way a very individualized training environment can be offered, of a sort which otherwise can only be found in a single-teacher/single-student relationship.

Upon completing these questions, users will get a personal working area on the server called "*locker*". It contains the following elements: *Courses Suggested*, *Courses Enrolled*, *Courses Taken* and *Private Working Space*.

In the 'courses suggested' section, students will find all courses that the system thinks would be appropriate for them. In the most trivial case, all courses available would be listed here. In the more advanced versions it would depend on the user's detailed profile whether or not a course will be listed here. This is also the place where students will select which course they would like to enroll in. If the user has registered for a course (using the *course registration*) it will be listed in the 'Courses Enrolled' collection which serves as the entry point for the course itself. The collection 'Courses Taken' may be used for administrative purpose, but can also function as a

private area for the student to maintain their own overview of any courses they have already mastered and how well they did. The 'Private Working Space' may be used as a working area for doing exercises or to store e.g. personal pages.

The course environment

After signing up for a course, each student will experience the course through access to the following functions: 'start', 'next/previous page', 'search', 'annotate', 'discussion forum', 'online chat', 'continue' and 'exit'.

Navigational aids

Whenever the student enters a course they will automatically arrive at the last visited page (or the introduction if this is the first visit), so that it is easy to continue after an interruption. To come to the next/previous page the user has to click on the 'next/previous page' button, 'start' will lead to the introduction page of the course and 'exit' will leave this course and bring the student back to the locker.

Searching in the background library

With 'search' one can query either a customized background library, the whole course content, the discussion forum, or the whole server. The background library is automatically generated during the course-creation process, based on the guidelines of the courseware author.

The annotation facility

Annotations can be placed within an HTML page using various annotation types; they are visualized with different icons that appear within that page upon its delivery from a Hyperwave server. These annotations can be made by either participating teachers or students; in either 'identified' or 'anonymous' mode (in the latter case, no information about the creator of the note will be stored on the server).

Note: The annotating document as well as the annotated document can (theoretically) be of any type (audio, video, whiteboard, etc...). However only with text documents serving as a base all features are available.

The discussion forum

Another form of asynchronous communication supported by the system (besides annotations) is a discussion forum, where each thread is hierarchically visualized. This is tightly integrated with the annotation facility, so that it is possible for an annotation to become the main starting point for a new discussion thread. Again a discussion contribution may be any document type, and the same combinations of annotation and user types are allowed. A discussion forum can be moderated (posted notes being checked and afterwards released to public by a moderator) or unmoderated (every contribution will be visible, according to the individual access rights, immediately after posting).

The online chat

The online chat can be used if two or more people are online at the same time. Students can chat amongst themselves, or even with the teachers within their office hours. Text may be augmented by drawings on a *whiteboard*, but in theory any document type is allowed (especially audio documents, as an alternative to text). A possibility to archive chat sessions (especially student-teacher chats) can be made available (and such sessions are afterwards treated like an asynchronous discussion).

4. GENTLE from the teacher's point of view

The system provides good tools to make learning easier and more efficient, but students can only benefit from them if teachers use the system for their courses! To increase acceptance the system has implemented a number of wizards and assistants to simplify several tasks. (These wizards are accessible when entering the courseware collection, if a teacher has the necessary access rights to create a new course.)

The course wizard

This is the main tool if a teacher intends to use the system to create a new course. The spectrum of possibilities starts with auxiliary support for a traditional lecture and ends at a self-contained Web Based Training course, where the teacher needn't physically meet the students at all.

Upon launching the course wizard, the teacher will be asked a few questions by the wizard:

- information about the teacher (name, image (to be uploaded or existing URL), office address, office hours, email address, home page, phone number etc.)
- if the system is supporting a traditional lecture: lecture hours and place
- title of course, table of contents and short introduction into course objectives, additional information (like special keywords categorizing the course content for the *course manager*) if necessary
- the teacher may select supporting material (from the online library) for the background library. If the online library is really huge, the teacher may specify the subject area using keywords to reduce the list of available books and choose the appropriate ones.

The fields for information about the teacher are preset and need to be filled out only if something changed since the generation of the teacher's profile. After filling out all fields in the form, the course wizard will create a *course skeleton* including the discussion forum, the background library, the 'introduction to course and instructor' chapter and placeholders for empty modules (according to the table of contents).

Even if a teacher does not want to invest more time, the students now have information about the course and the teacher electronically available. In addition, the course will automatically be supported by a discussion forum and a background library (if the instructor selected some books during the course creation process). Of course the students would benefit much more from the system if the teacher decided to create more detailed online course content. For this purpose the instructor may use the *page wizard*:

The page wizard

The page wizard helps the teacher to design and create a new course page or to edit a pre-existing one. When creating a new page, the author can choose from several different templates (e.g. a template for material to accompany a traditional lecture, or some chosen template for a pure online course, etc.) and then change the style and color according to their own taste.

After creating a new page the teacher may use the wizard to access editing tools to rework the page. The integration of many editing tools (HTML-editor, HM-card, Macromedia Director etc.) is configurable to support whatever tools are in common use at this campus (campus-wide software), or special ones that correspond to the author's preferences.

The module manager

The module manager is important if there are a large number of course modules (each course consists of modules) that are stored in the module repository. The module manager can be used to categorize each module, in order to simplify administration. One can thus automatically generate a completely new course out of

existing material, just by specifying some keywords. The manager will then suggest a list of modules that fit these categories. If access rights permit reuse, the author may link these modules in the new course or make a physical copy and rework the module according to the new requirements. The billing mechanism of Hyperwave can even be used to establish a global 'trade' in courseware modules.

The course manager

The course manager is used to automatically assign courses to students (in the 'courses suggested' folder). Decision criteria for this might be the syllabus, a career plan etc.

The offline wizard

This tool will be used to create a special offline version of a course that works without the WBT server. Nevertheless should key features as searching and adding private annotations will still be supported by the offline version.

A more powerful version could also support going online from time to time, to synchronize the offline content with the server (very important for discussion forum and annotations!).

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