Using Knowledge and Know-how to Discriminate between Presence and Distant Teaching

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ABSTRACT: This paper relates a real-size experiment about implementing a Web-based degree of the masters level in computer science. Using the Web as both a library and a classroom is a logical way to set up distant learning, especially when the target student population is connected at office as well as at home to Internet facilities. We chose to sort the assets of our problem in order to answer this first question: Is the teaching of computer science adapted to total distant learning? So we created a degree from scratch , picked up an experimental group of 15 students spread in three categories (professional, students in other degrees, plain students), implemented and delivered the most sensitive courses (those that mingled knowledge and know-how). Asked about the three crucial items about which we needed information, i.e. 'Knowlege' (distance) vs 'Know-how' (presence), document format, and distant tutoring via e-mail, the students applauded at the splitting we chose between attendance and sole e-learning, definitely preferred multiple formats, and seemed to prefer face-to-face questions and relationships.

KEYWORDS: Web based learning, distant learning, distant graduation, computer science teaching, education-oriented WEB architecture.

1. Introduction

This paper relates a real-size experiment about implementing a Web-based degree of the masters level in computer science. When literature is very abundant about theoretical requirements for Web-based education, and technical propositions about tasks and documents format on the Web for instruction, few have directly picked up the problem of graduating people, and all what this involves in terms of building a

Web-based only degree. Facing the necessity of being directly operational within a University institute totally devoted to distant learning (IED), we had to follow a real bottom-up methodology: so instead of devising the "how" and trying to specify or use generic platforms and tools, we had to go directly to creation and implementation of a degree. This "time and result" constraint imposed a certain amount of pragmatism that led us to design both an instructional program, a system architecture and an experiment matching the following set of constraints and goals: what would be the sufficient requirements in theory, software and architecture for managing a high-level degree that would provide the students an original instructional program?

The following sections and paragraphs go through this check-list by:

Examining the rationale for distant learning
Browsing the theoretical issues in Web-based Education
Building an experiment based on our constraints
Implementing the most adapted architecture
Reporting for the first emerging results
And last, concluding about the results and products to come.

2. Rationale for Distant Learning

2.1. Why distant learning

Very obviously, distant learning becomes necessary whenever potential students are geographically distant from the University or College providing the particular course they are interested in. Indeed, moving is not always affordable: for instance, a good percentage of the 3300 students in psychology at IED (created by the Psychology Department of Paris 8, which has been working as a distant learning structure for a decade) live in distant Polynesia (10, 000 miles), or in the French Caribbean. However, distance, as a rationale for distant learning, becomes more and more overwhelmed by **time availability**. Students already working in companies and aspiring to a better position are soliciting university, especially in France where it is a free service. Moreover, education provided by universities is, traditionally, product-independent, and is concluded by a degree, valid in France as well as in Europe.

For all these aspects, the “market” for distant learning in professional skills is widening everyday, and the generalization of new information and communication technologies has not only increased the pressure, but eased the means to provide distant courses, and thus graduate a maximum of students.

2.2. Using the Web

Using the web as both a library and a classroom is of course not a new idea, but a logical way to set up distant learning, especially when the target student population (i.e. the working population) is nowadays connected at office as well as at home to Internet facilities. This aspect has already been dealt with in every "Open University" created in the Web site of many universities in the United States[1] and Northern Europe. On the industrial side, software companies have proposed products such as Learning Space, the Virtual Classroom, and so forth. From an academic point of view, many articles have contributed, already in the eighties, to sketch an overview of what distant learning in Universities should aim at (see for instance [Ysewijn 1989]). Aside from computer aided learning (CAL) and computer aided interaction (CAI) in Education, which are illustrated through an abundant literature, researchers have focused on net-based learning specifications at the University level since the early nineties. The number of articles dedicated to Web-Based Learning (WBL) is so important that it would require a complete "state-of-the-art" study. Therefore, in this paper, we will focus on the references that are the most directly relevant with the specifications of the problem we deal with:

Teaching computer science through the net;

Aiming at degree delivery (Masters of Science level of graduation);

Addressing an busy population (i.e. professionals).

These constraints have led us to try to answer the following questions:

Is the teaching of computer science adapted to total distant learning?

Is it possible to reach a graduation (at masters level) with distant learning only?

Has the type of population an impact on failure by abandon percentages?

Will such aims impose a particular architecture to the system?

3. Educational issues in teaching high-level skills in computer science

3.1. Computer science seen through the typology of Schank and Cleary

Teaching computer science through the Web would appear natural because the means and the contents of the teaching are related. However, often students' attention drops when following software tutorials and their failure is here to remind us that familiarity with computers does not mean a cognitive preference in computer-stored texts as a mean of learning. Schank and Cleary (SC 1995) have developed a model they call "teaching architectures". They have matched cognitive theories against learning domains, and concluded to the necessity of highlighting key elements.

If we consider that teaching computer science refers to:

Engineering type of learning (machine and software architectures, networks);

Concept learning (basic concepts);

[1] Among them: University of Colorado (CoVis resources), MIT Media LAb, University of Illinois; University of Hawaii, university of Southern California…

Language learning (formal languages);
Procedural learning (for particular skills such as debugging, restoring after failures and so forth).

Which are among the categories provided by the authors, then the associated theories that are the most relevant (i.e. those which score the most) would be, in their representation:

Anchored instruction (matching engineering and conceptual learning);
Mental models (matching language and procedural learning);
Social development (matching engineering and language learning).

Schank and Cleary (op. cit.) and later Campbell (Campbell 1997) who is inspired from the aforementioned, implicitly consider that learning is equivalent with problem-solving or task performing. Thus all key elements given by these authors are related to:

Task decision making;
Problem solving;
Navigation (to answer a particular question);
Application (to a new situation).

Of course, these criteria are relevant when measuring the result of learning is at stake. The problem we have when we deal with a given topic in which a student has little knowledge, is to differentiate between:

the basics (concepts) and the events (problems);
what is a rule and what is an exception;
what is to be packaged and what is to experience.

In other words, if we have to design a temporal succession of educational actions that could be compatible with the patterns of Schank and Cleary we would:

Teach first the basics as “anchors” around which some events (or problems) could be arranged, thus highlighting the anchored instruction trend as an answer to the typology of computer science as engineering and concept learning. These anchors would have to be inspired from hierarchies that are key elements to mental models (language and procedural learning).

Rules would be provided through examples of realistic problems (key to anchored instruction).

Second, the differentiation between rule and exception would have to be “experienced”: coaching, modeling, imitation, which are key elements to the social development trend of computer science (Engineering and language learning), mean that interaction is to be achieved as a face-to-face between teacher and student.

Last, only when basics are delivered and differentiation between concepts and events, rules and exceptions, has been suggested by a teacher, that one is able to measure knowledge acquisition through task decision making, problem-solving, relevance of navigation and of knowledge application to a new situation.

3.2. Building a highly skilled course

3.2.1. Specifying distant learning versus presence learning

Instead of focusing only on the cognitive theory of learning to build and architecture, we chose to sort the assets of our problem in order to answer the first question we asked ourselves: *Is the teaching of computer science adapted to total distant learning?*

So we tried another pattern that is less sophisticated but nevertheless appeared as easier to experiment. According to a cognitive study we made about the properties of knowledge and know-how (Prince 1996) we decided to use the difference as an Occam's razor between distance (web-based) and presence (relationship to a "flesh-and-blood" teacher) in learning. Here is where we've gone**:**

> All the static conceptual parts, the known rules and strategies, the case-based scripts are "knowledge" that could be provided through Internet.
>
> All the dynamic parts, where exception is to be recognized, and "direct manipulation" is to be experienced, are relevant to "know-how", and are to be provided by the flesh-and-blood teacher, but only after the knowledge requirements are delivered and studied.

Thus, if we go back to Schank and Cleary's cognitive theories, social development has to come at last. Now, more relevant to this later aspect is their "experiential learning", related to the sole item "engineering" in their architecture (by the way, this enhances the "engineering" classification of computer science). Among the key elements to the application of this theory, they suggest: meaningful tasks, degree of personal interaction. So we think that the setup for experimental learning could be ideally embodied in a one-day (or maximum two days) meeting in which practical works would be performed in common by the students.

3.2.2. Masters degree and course typology

If many computer science courses have been proposed through a WBL environment (see for instance Warkentyne and Delafontaine [WD 1995] who were among the first, in Europe, to describe a Unix-teaching experiment), however, seldom have "complete" diplomas being teached through WBL only. This was the challenge we had to meet: to take as an input students with a BS[2] level, and bring them to a masters level through WBL, on a new subject, "distributed applications design", that was not in the directory of our University degrees. So we had to design a complete set of courses for a high-skilled degree in computer science, and design them for WBL from scratch.

According to the constraints of knowledge and know-how we divided courses in three types: theoretical, methodological, and application-based matching division

[2] Bachelor of science degree

between knowledge and know-how, distance and presence, categories of learning items (basics and problems, rules and exceptions, packages and experience).

type of course	Percentage in Knowledge and know-how	TYPE of LEARNING	Web-based
Theoretical	Knowledge only (BASICS and their PROBLEMS)	Concepts	100% No presence required
Methodological	Mostly knowledge, a bit of Know-how (RULES AND EXCEPTIONS)	Concepts, Engineering, Procedural	80% One day of presence per course
Application-based	Mostly know-how, a bit of prior knowledge (PACKAGES AND IN VIVO EXPERIENCE)	Language, Engineering, Procedural	50% Two days of presence per course

The degree was designed as such:

Five courses of the theoretical type about: complexity and algorithmic, application design basics, distributed data and flows, mobile agents on the net, distributed algorithms.

Six courses of the methodological type such as: using and managing networks with Unix (2 courses), data-mining and data-warehouse, information security with networks, text-data bases and new languages, Object-oriented methodologies.

Four courses are of the application-based type such as: client-server architecture for applications (two different courses), intranet development, interactive communication and design.

Last, an overview of the professional environment, is developed in a narrative mode through two courses: how to master costs in projects management, and what are the basics in distributed application project management. These last two, being more of the "problem" type associated to basics, are provided in the liking of a theoretical course.

3.2.3. Temporal succession and distance-presence rate

3.2.3.1. Temporal succession

The suggested temporal succession in taking up courses is of course: (i) pure Theoretical, then (ii) Methodological, then (iii) Applications, professional environment being classified outside this list. (Professional environment could be undertaken anytime during the time allowed to WBL).

However, as all courses are to be available on the net (at least in their "knowledge requirements" parts) it befalls on the student to choose the succession of courses they want to undertake.

3.2.3.2. Student time

Moreover, the suggested student-time (the concept of one hour course through a term is no more valid in distant learning) dedicated to each course is to be around 38 hours. This involves:

Reading the knowledge requirements;

Solving exercises;

Navigating through the web to acquire more information about some points;

Communicating with a tutor (asking questions) or the other students (exchanging ideas through a forum);

And, for the methodological and application based courses, working in a real classroom in a simplified but real-type environment: this amounts to 8 hours over the 38 for the methodological course and 18 hours over the 38 for the application based course.

In the degree design document, the seventeen courses required for the degree amounted to 646 hours of studying. This was seen as a minimum, of course. Thus, we suggested that the degree should be obtained in two years (instead of one, as it is usual in France). As for the number of presence days throughout these two years, it was not supposed to exceed 20 days.

Therefore, it first appeared very likely to offer such a learning environment for undergraduated professionals, who wanted to get a high-level degree with less than three weeks of presence in a University classroom.

3.3. Building an experimental group

We chose first to build a small experimental group of students to match the requirements derived from the two impending questions:

Is it possible to reach a graduation (at masters level) with distant learning only?

Has the type of population an impact on failure by abandon percentages?

Therefore, we stopped at 15 students, with the following profiles:

All had at least a BS degree in science: one was a mathematician, two others studied electronics but all the others were graduated in computer science: focusing on computer scientists helps the experiment not to get tampered with adding cognitive difficulties. Distant learning is in itself a situation where graduation is not easily envisaged, so we wanted to be the closest to a "best conditions" type of situation.

Five only were not professionals: we had to know whether time and cognitive availability were important issues or not, in order to answer the question about the relationship between the type of population and the failure by abandon percentages.

Time availability is defined through the ability of devoting time to a task. For instance, both professionals and students in another degree have low rates in time availability.

Cognitive availability is defined through the ability of mentally focusing on the time. Some professionals, working in a completely different domain that they master, are supposed to be more available than people trying to achieve another degree.

In the 15 students we chose, there was 10 professionals with a low time availability, but an average cognitive availability, 4 students (2 PhD, 2 masters) working on another subject, with both average time and low cognitive availabilities, and last we had 1 student who totally devoted his time to our educational program.

Prior environment: number of students	Computer science: 12	Mathematics: 1	Electronics: 2
Time availability	Low: 10	Average: 4	High: 1
Cognitive availability	Low: 4	Average:1 0	High: 1

When matching availability criteria with prior environment and status, we had:

Prior environment: number of students and status type	Computer science: 8 professionals and 4 students in other degrees	Mathematics 1 One professional	Electronics 2 One Student One professional
Time availability	Low: 8, Average: 4	Low: 1	High: 1, Low 1
Cognitive availability	Low: 4, Average: 8	Average:1	High: 1, Average: 1

The latitude for choice was small: as the degree was just created, we had to pick up the first fifteen who at least matched the discipline constraint.

3.4. Specifying an adapted architecture

3.4.1. Software environment

The basic paradigm of publication on the web is freedom, which in the case means no property nor intellectual rights on what is offered through web pages. This is merely not compatible with delivering high level and up-to-date know-how on subjects such as Corba and three tierce Java applications, especially when the teachers are professionals.

This point only is sufficient to explain the choice that was made for an extranet with authentication of students on the basis of their administrative enrollment. On-line registering, a classic offer of many open universities, is therefore not applicable as students have to send hard-copy documents to the University administration. This last step is anyway a prerequisite for every national diploma in France, so we just had to use it positively.

The system was designed to rely on free software packages (GNU/Linux) with very poor requirements on the "client" (i.e. user) side: a web browser such as Mozilla or Hot-Java will perfectly suit most of the needed functions. This is the case at least for the psychology classes. Actually, because of the numerous software tools that are used, going through the course of our masters degree in computer sciences leaves no other way than having an Intel-based, GNU/Linux powered personal computer.

3.4.2. Services offered to students

Once a student (or a teacher) has gone through the authentication process, using confidential information he/she received hard copy from the University administration, he/she is registered in the local domain and benefits from the following services:

access to documents summaries and sources, according to the courses he/she has signed in;
access to general Internet and mailing services;
access to local and predefined mailing lists, according to the courses he/she has signed in;
access to a personal storage space with a referencing system;
access to a mail-based tutoring service;
access to personal educational services.

The personal storage space is intended to enhance the situation of working students who can use this facility to exchange documents between the different places they might be able to study in (home, company, open Internet places).

The mail-based tutoring service comes up as a complement of the traditional phone based tutoring service that we are running since ten years now, and that we will still run.

4. Web Based Learning Experiment

Setting up a WBL experiment meant, after picking up an experimental group, upon which our control was scarce, to:

Choose among the 17 courses the most sensitive to difficulties
Examine the Web format of documents
Schedule presence days

So that after eight months of experiment, we could at least derive some conclusions from the salient results, if there were any.

4.1. Chosen courses

Choosing courses that are the most sensitive to difficulties meant literally choosing those in which knowledge and know-how were intermingled. Thus we took up the 6 methodological and the 4 application-based courses as the setup of our experiment. Of course, it would have been better if we could begin with theoretical aspects, in order to get data about the "real thing", however, we were afraid that people, without a personal "flesh-and-blood" interaction with a teacher or a tutor, would abandon and be discouraged. Therefore, we thought to "capture" them through their fascination for technical aspects. As we will report below in the results section below, this option was profitable.

4.2. Web pages format

The document format is again a non trivial question that can get answered both from a system point of view and from an educational point of view.

Going through the analysis of flows in a WBL system, it becomes quickly obvious that there has to be more than one type of document. Although the basis of a complete course can be offered as a set of HTML based documents, most of the exchanges are e-mail based. As it is a hard constraint to require that all mail exchanges should take place in HTML format, the system should at least deal with plain text format along with HTML.

One should expect that more formal answers will soon appear to this document format problem inside the system, but none of the one we could think of were available by the time this system was built up. Our opinion is that one very good hint to look after is XML, which will give, among a lot of advantages in transferring, referring, and manipulating documents, a real unique document format in the system. Unfortunately, the technology is too young at the time and there are no "on the shelf" XML authoring and browsing tools. Moreover, in this case, the database file referencing application has to be written. On the opposite, and much more advanced in automatic database file referencing, a promising hint is the use of a multimedia database as the plinth of the system. Especially when a web based interface is deliverable to end-users through basic browsers: the "Internet File System" recently proposed by Oracle® should therefore go under evaluation if it is free software. In this case, unfortunately, there will probably be no unique document format in the system and some difficulties are to be expected in document exchange if document formats stay tied to specific applications as it is the case now.

A completely different approach of document format is the educational one. In the specific case of our masters degree in computer sciences, the question of the web pages format has remained open for months, although much time has been spent in discussions on this topic.

The main arguments that have been developed could be split in different categories that, not surprisingly, match with the type of users that were present in the design team:

authors. Authors don't share the same skills in web authoring tools, and some of them who are using non web designed supports (from videos to slide shows) don't feel any urgent necessity to move to HTML.

tutors. Tutors need to have at-hand every document the students may refer to when asking a question. They like HTML as soon as they have a good connection during their working hours. But hard-copies are welcomed as well because some of the questions require some thinking about technical points.

students. For the students' representatives, the document format should not be unique, and certainly not uniquely HTML, mostly because it is very bad for printing as soon as you get more than a few pages. Although, HTML is perfect when one wants to "zap" from one page to another to get an idea of the subject. Let us give some other reasons we received: some of the students are not used to screens, some of them don't even have a personal computer, some of them can't afford long Internet connections, some of them do prefer hard-copy documents.

project managers. From the project manager's point of view, the costs of every solution have to be considered before any decision is to be made.

Between such numerous and opposite opinions, trade-offs had to come up… For our experimental group, the decision was made to offer as many formats as it was economically possible to produce for each document given by a teacher. So the students were offered formatted text documents, quickly left to the benefit of Rich Text Format (RTF) versions perfectly suited for printing. Classic web ".html" versions were also available, but slide-shows documents were also proposed. No formal rules on ".rtf" and ".html" presentations were given to the authors because we were interested in the feedback from the students in front of the different techniques used.

Besides the knowledge textual documents, the computer science masters degree has a highly technical and wide spread content, which imposes the use of many different tools (Java SDK, BDK, EJB, Corba and IDL, UML, XML, and SGML packages among others). We offer the sources of these tools on our servers to facilitate the working process of the students, with as much operating systems choices as possible.

4.3. Scheduling presence days

Presence (or attendance) days were regrouped into two sessions. One session in December, (about 10 days) composed of the practical works and tasks related to the methodological courses; and one session in April (also about 10 days), related to the application-based courses. This organization of time is to be reproduced every year without any change, so that students may plan their attendance to presence days. This year, the theoretical part (knowledge) of the methodological and application-based courses was available to the students at least one month prior to the presence sessions. The student registered in the session days according to their time availability. A duplicate and accelerated re-presentation of some courses was given in June, so that the people who were not available for the end-of-trimester sessions could nevertheless follow the courses they have missed.

However, as the degree runs for two years, people not available the first year of their registration are free to postpone their courses to the second year. Anyway, as the remaining theoretical courses, forecast for the following year of the experiment, do not require any presence, the students are technically given the facility to schedule their presence in the year to come, as best as they can afford.

5. WBL System Features

Authentication techniques used to secure Extranet and Intranet architectures are common nowadays, so we will focus in this section on some specific services introduced before:

access to a personal storage space with a document referencing system;
targeted document sharing;
access to local and predefined mailing lists;
access to a mail-based tutoring service;

all of them being offered through an HTML interface.

The general architecture of the system is described on figure 1 (next page). The "Intranet Welcome Page" names the HTML interface any user has to interact with the system. The schema shows three main subsystems this interface gives access to: (i) a classical e-mail service (on the right hand side), (ii) the personal space manager (in the center), (iii) and the e-mail tutoring service (on the left hand side). Both the personal space manager and the tutoring services rely on database systems.

5.1. Personal storage space

Once authenticated in the local domain through the firewall, every user is given access to its own personal space, a place where all the documents are referenced in a database. Please note that no direct access to documents is ever given to users: each document is reached through a reference card that has to be filled by the author of the document when it is uploaded in the system. Users don't have any access to a shell or a file system. The disk quota facilities are used on a per user basis.

On the welcome page, one would see in blue background color what is related to courses (list and research), and in green background color what is related to personal documents. Compared to the student interface, teachers have a supplementary special blue item for uploading new courses in the system.

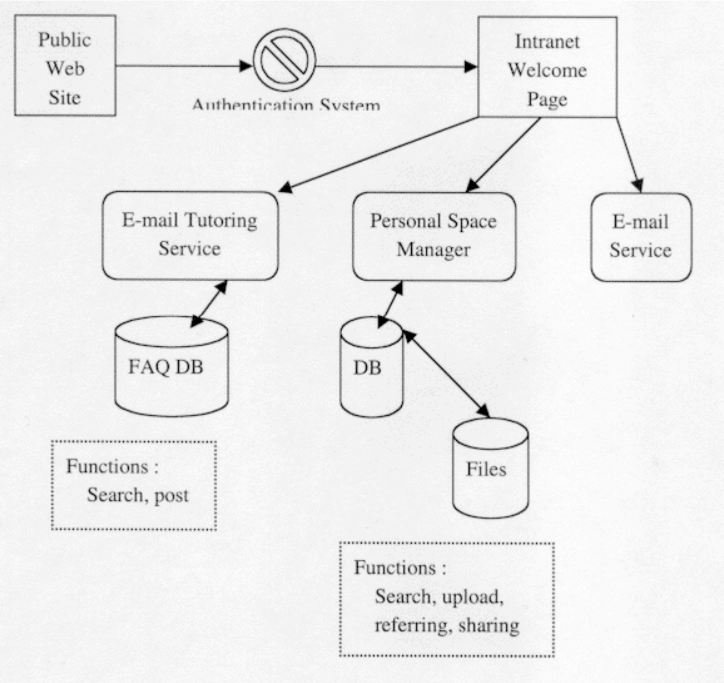
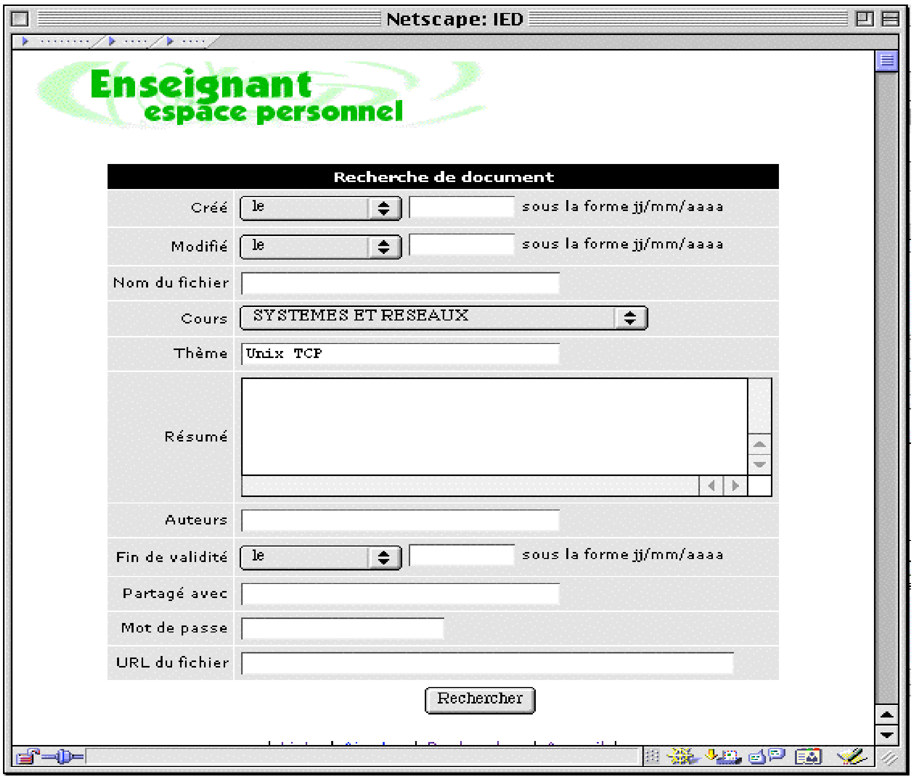


Figure 1. General architecture of the system

5.1.1. Document search

Looking for a specific document is done through an HTML form (see fig. 2), that reveals some of the criteria we use to reference documents in the database, among which dates of creation/modification, name, related course, topic, and author. Each document present in the system has a corresponding reference card in the document database. From a user point of view, student or teacher, each document database is seen as personal and there is no way to list another user documents. Referencing a document is done through both public keywords demanded by the interface, and free keywords chosen by the user. The free keywords are only to be seen by the author of a document: they are its own key storage clues. Shared public documents such as courses are not stored in the personal storage space of a user.



Recherche de document

Créé	le	sous la forme jj/mm/aaaa
Modifié	le	sous la forme jj/mm/aaaa
Nom du fichier		
Cours	SYSTEMES ET RESEAUX	
Thème	Unix TCP	
Résumé		
Auteurs		
Fin de validité	le	sous la forme jj/mm/aaaa
Partagé avec		
Mot de passe		
URL du fichier		

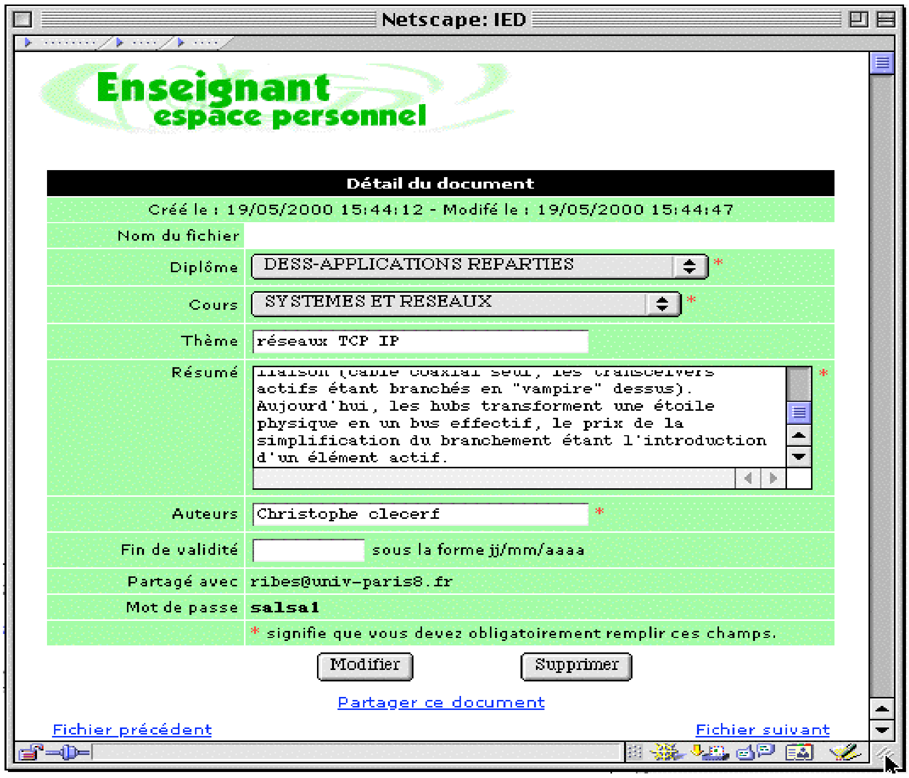
Figure 2. A screen snapshot of the document search form.

The results of a search in the personal database appear as a table of hyper-linked documents references that, when activated, will either show up the detailed card of the document (see figure 3) or the document itself through HTTP access. The detailed card gives access to the document sharing service.

5.2. Managing Communication and Sharing Documents

5.2.1. Targeted document sharing

From the detailed card, which does not show the name nor the localization of the file in the system, it is possible to share the document with other users of the system. Only the e-mail address of such users that will have access to this document appear on the detailed card (here ribes@univ-paris8.fr on the fig. 3 snapshot).



Détail du document

Créé le : 19/05/2000 15:44:12 - Modifé le : 19/05/2000 15:44:47

Nom du fichier	
Diplôme	DESS-APPLICATIONS REPARTIES *
Cours	SYSTEMES ET RESEAUX *
Thème	réseaux TCP IP
Résumé	liaison (cable coaxial seul, les transceivers actifs étant branchés en "vampire" dessus). Aujourd'hui, les hubs transforment une étoile physique en un bus effectif, le prix de la simplification du branchement étant l'introduction d'un élément actif. *
Auteurs	Christophe clecerf *
Fin de validité	sous la forme jj/mm/aaaa
Partagé avec	ribes@univ-paris8.fr
Mot de passe	**salsa1**
	* signifie que vous devez obligatoirement remplir ces champs.

Figure 3. A detailed card referencing a personal document.

Document sharing is made possible while maintaining protection of personal documents because such privileged users receive an URL pointing to the reference card along with a password that give them access to it, rather than an URL to the document itself.

5.2.2. Predefined Mailing Lists

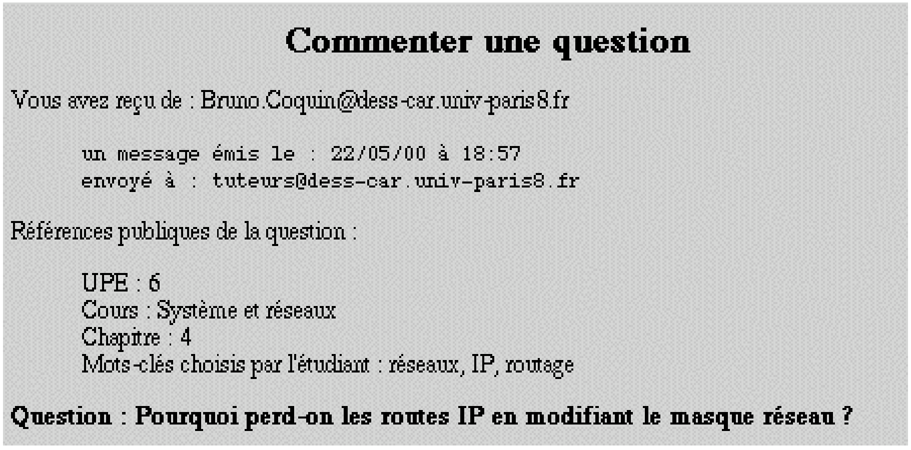
When signing up to a course, a user is automatically listed in the mailing lists related to this course. Depending on its type, a course gives rise to one (mainly the theoretical type) or more mailing lists (attendants in application based courses are subdivided in small groups). Anyhow, the names of these mailing lists may be used a standard user e-mail address, thus offering the capability to share a document with all the members of the list in one item.

5.3. E-mail- based Tutoring System:

The tutoring system is organized around FAQ databases that contain the label of questions as entry. Tutors update the databases, referring to the questions sent by the students, according the following procedure.

When having a difficulty, a student is oriented towards the FAQ system. There, a search engine will look for his point either through the label of questions only (narrow search), or through the questions and answers text (wide search). The student is given a list of answers classified with pertinence criteria. When the student believes that he did not find his answer, he will ask to send a question to the tutors, classifying it with public key references. His question will be sent by e-mail to the tutoring system rather than to a person, and the e-mail is dispatched toward a tutor according to the public key references, which are also used to classify the skills of the tutors.

When receiving a question (see fig. 4), a tutor may choose to comment it and to update the FAQ database with its answer. In this case, a new entry is made in the database with the label of the question given by the student. Re-formulations of the question by the tutor may be done, making a new entry in the database related to the same answer.



Commenter une question

Vous avez reçu de : Bruno.Coquin@dess-car.univ-paris8.fr

```
un message émis le : 22/05/00 à 18:57
envoyé à : tuteurs@dess-car.univ-paris8.fr
```

Références publiques de la question :

UPE : 6
Cours : Système et réseaux
Chapitre : 4
Mots-clés choisis par l'étudiant : réseaux, IP, routage

Question : Pourquoi perd-on les routes IP en modifiant le masque réseau ?

Figure 4. A question as a tutor would receive it from a student through the tutoring system.

Tutors can give answers that may be completely new ones, or built with a copy/paste text move, as well as a short comment with reference to another entry. They could be also:

Bibliographical references
Related site address
Reference of a freeware product relevant to the subject
Reference to an example or an exercise already proposed by the teacher.

This means that the tutor has to run a constant technological survey, and to be aware of the last achievements in the domain. This develops a "domain informational expertise" that we want to study further on in order to suggest a better setup of an efficient distant learning.

6. First Results

The first result we get from the experiment is that for the moment no student abandoned the masters degree. Three did not come at all, but were still registered: they may be present next year, as they are allowed to. Twelve were seen from seldom to always in the presence sessions.

So, the first conclusions we can get after interviewing the students (since the first examinations have not yet produced results) are about:

the discrimination between knowledge (distant) and know-how (presence) in learning

documents formats

a Web-based educational program

communication and e-mail tutoring

6.1. Discrimination Between Knowledge and Know-how

Students were very happy with presence days. They expressed their satisfaction very keenly. In particular, they said that it was a good thing to get the theory before, to read it slowly, at their own rhythm, and then to be able to "feel " better the exercises setup provided during the presence days. They appreciated the face-to-face communication very much, feeling that presence days were real "milestones" in their educational program, in which they felt the tangible aspect of their relationship to University. *Time availability* played a role, but professionals were not the ones we saw the least. *Cognitive availability* was in our point of view a more discriminative criterion. Students in other courses found it hard to maintain their attention in both degrees, especially that distant learning heavily weights on the mental resources of the students.

6.2. Documents Format

Our hunch about not focusing on the design of document formats seemed to be confirmed by students. They definitely preferred multiple formats instead of a unique sophisticated one.

For the knowledge parts of their courses, they favored a text (RTF, Word) format, so that they could print the document, read it anytime, write upon the document, and so forth. For the navigation and exercise parts they of course preferred an html format, but the simplest possible. They did not show any interest in the "slide-show" format, which was supposed to be more user-friendly.

6.3. A Web-based Educational Program

Although the program, in both course delivery and interaction, was supposed to be Web-based in its distant learning part, students asked for a back-up procedure based on a CD-ROM for course delivery. Problems with connections and providers made us create a CD-ROM offered to the students only for the static information part. Many complained about the unreliability of a totally net-based interaction. So, this reinforced their appreciation of attendance days.

6.4. Communication and e-mail Tutoring

Surprisingly, this first group of students did not communicate much. Some teachers were disappointed because interaction was almost reduced to nothing. When asked about that, the students were dispersed in their answers: some felt that questions were answered during presence days, other said that they still needed more time to grasp the real content of the courses, which, in their opinion, were of a very high level. However, it seems that people began to be more talkative towards the end, when they were more familiar with each other, and with the contents of their program.

7. Conclusion

In conclusion of the first step of our experiment in WBL of Computer Sciences, those are the first impressions we had about questions that were asked.

> A totally distant learning is definitely not desirable. Students still need a face to face communication with the teacher, and the feeling that they are related to University in time and space. Our "Knowledge -Know-how Occam's Razor' seems, until now, to be in accordance with the needs of the students.
>
> The sophistication of the software platform is more a nuisance than an advantage. Students are not very interested in complicated tools and need to get gradually familiar with another way to learn. For that, they like paper-based documents for academic parts, and prefer to use freely the Web for their personal searches about a subject. They are still not very talkative, but this can arise from their lack of experience in distant groups interaction.

Some points also raised from the course of the experiment, such as the necessity of back-up procedures. The unreliability of connections and providers does not help a totally Web-based structure. If a CD-ROM may back-up an academic document, presence seems to back-up e-mail interaction and chat. So although we devoted a lot of time in designing the tutoring architecture (a part that is yet to develop in another report), the experiment has to be repeated with a thorough focus on distant coaching. We think that the little number of students tends to favor a personal interaction outside mailing lists. As the number of students will reach 45 next year, we believe that this will help get a better overview of tutoring results. In the same time we will have to study the impact of totally distant learning, with the delivery of the 7 remaining courses of the theoretical part. We think that these courses will allow us to better observe the tutoring service, since no attendance day are forecast: the student's behavior will probably change when faced to the necessity of a sole e-mail and forum communication.

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