Adaptation of the Links in an Educational Hypermedia

Debbah Amina, Bensebaa Tahar, Hafidi Mohammed, Mohamed Ben ali Yamina
Laboratry of Computer Science -LRI
Department of Computer Science University of Badji Mokhtar
Annaba, Algeria
Amina.debbah@gmail.com, T_bensebaa@yahoo.com, benaliyam2@yahoo.fr

ABSTRACT: *On the Web, electronic documents are usually presented to readers as a hypermedia.*

The characteristic of this traditional hypermedia lies in the fact that the same pages and same links are often presented to all users. But these users are different from each other according to their needs, their knowledge of the subject they treat, or other characteristics of their own, etc.. Thus, they may not be interested in the same information and do not follow the same paths or links in their navigation. More disorientation and cognitive overload are the largest, is the aim of improving the adaptation this article we will present an approach for improving the adaptation. It is essentially based on a learner model and a domain model.

Keywords: Hypermedia, Cognitive Overload, Disorientation, Adaptation, Learner model, The Domain Model

Received: 2 November 2012, Revised 21 December 2012, Accepted 27 December 2012

1. Introduction

The traditional hypermedia offers to users an access to all pages and links as information and links not relevant to a user but presented it did cause a cognitive overload. The user is easily lost in the sometimes vast extent of hyperspace. He has often struggle to find himself the paths it has previously used and it easily turns around in his career links. He often finds it difficult to assess the amount of pages it has already visited - or still to visit. Rapidly the user may misinterpret the document and make a bad mental representation of the structure of hypermedia.

In this respect, and in an approach to improve traditional hypermedia systems that were born adaptive hypermedia systems and dynamic adaptative hypermedia systems.

Our work focuses on the realization of an educational adaptive hypermedia system. This system focuses on the adaptation of the navigation.

2. The Approach

Our approach, as any adjustment in a hypermedia system, is essentially based on two main elements which are the model of the learner and the domain model. Let's start by defining each of them to better understand how they work later.

2.1 The Domain Model

We call any resource domain model that allows an agent (the expert, the user or system) to extract knowledge, so useful

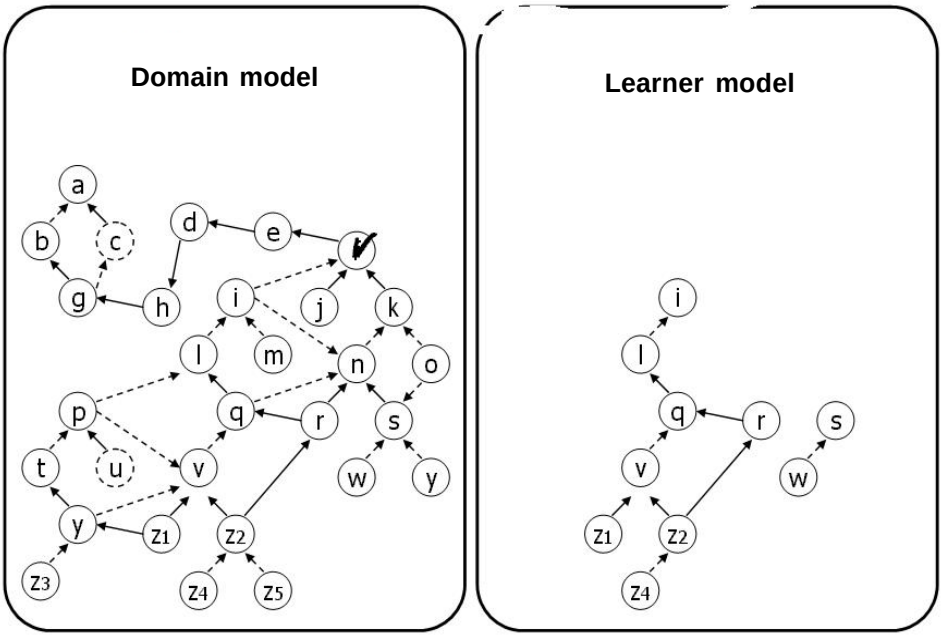

Figure 1. Initial state of the learner model

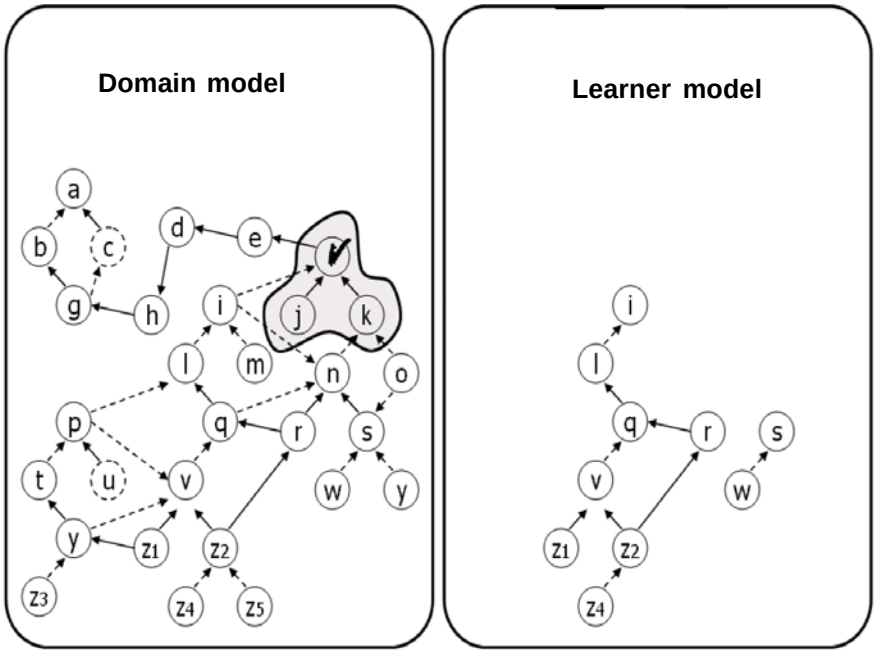

Figure 2. Use of precedence relations

information to the task. [1].

In our approach the domain model is a set of concepts, connected by two types of relationships that is a precedence relation and a relation of sufficiency that we will detail later. "*Figure* 1" shows a view of the domain model.

2.1.1 The concepts

We call concept all that a teacher can set as a learning objective. A concept can be either knowledge or know-how. An *N* concept is characterized by:

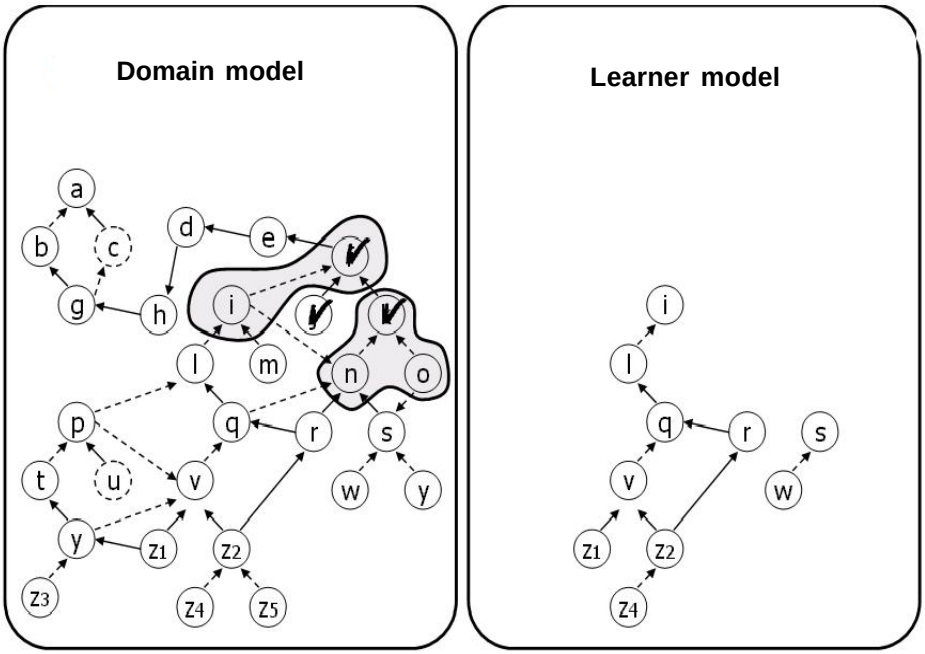

Figure 3. Use the relation of sufficiency

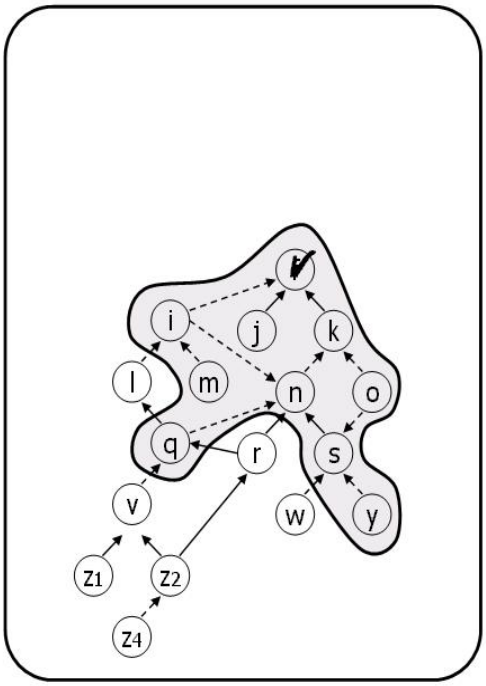

Figure 4. Graph concepts

• **A label L**: it is a symbol. It is supplied by the teacher when it creates or modifies the domain model.

• **Control M:** it is a real between 0 and 1 representing the learner's supposed knowledge of the concept.

2.1.2 The relations

Relations are used to organize the concepts in the domain model. We distinguish two types of relations: relation of conditional precedence and relation of sufficiency.

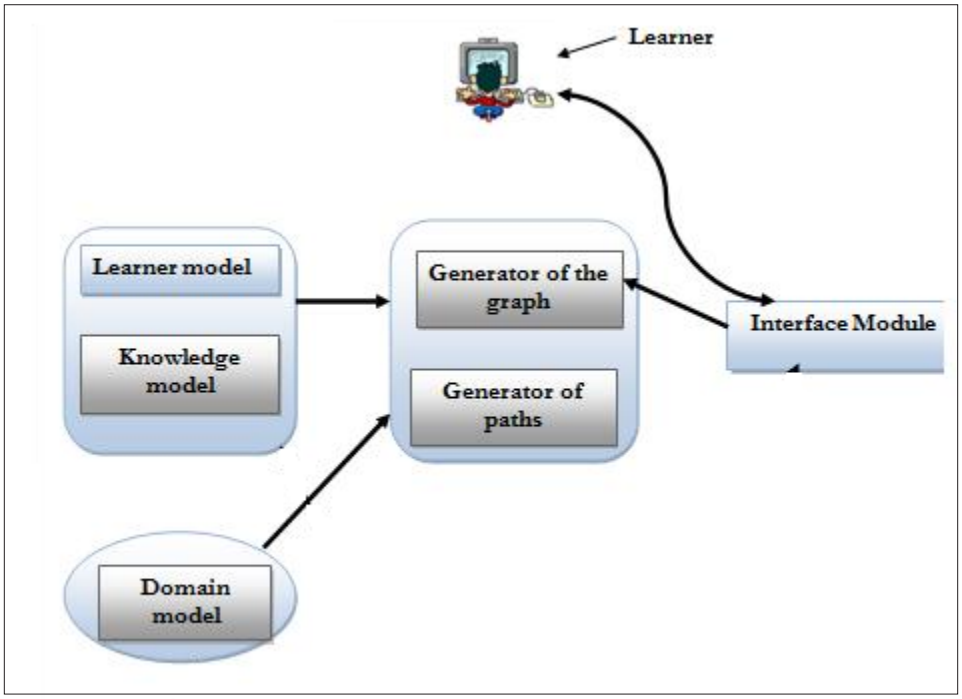

Figure 5. System Architecture

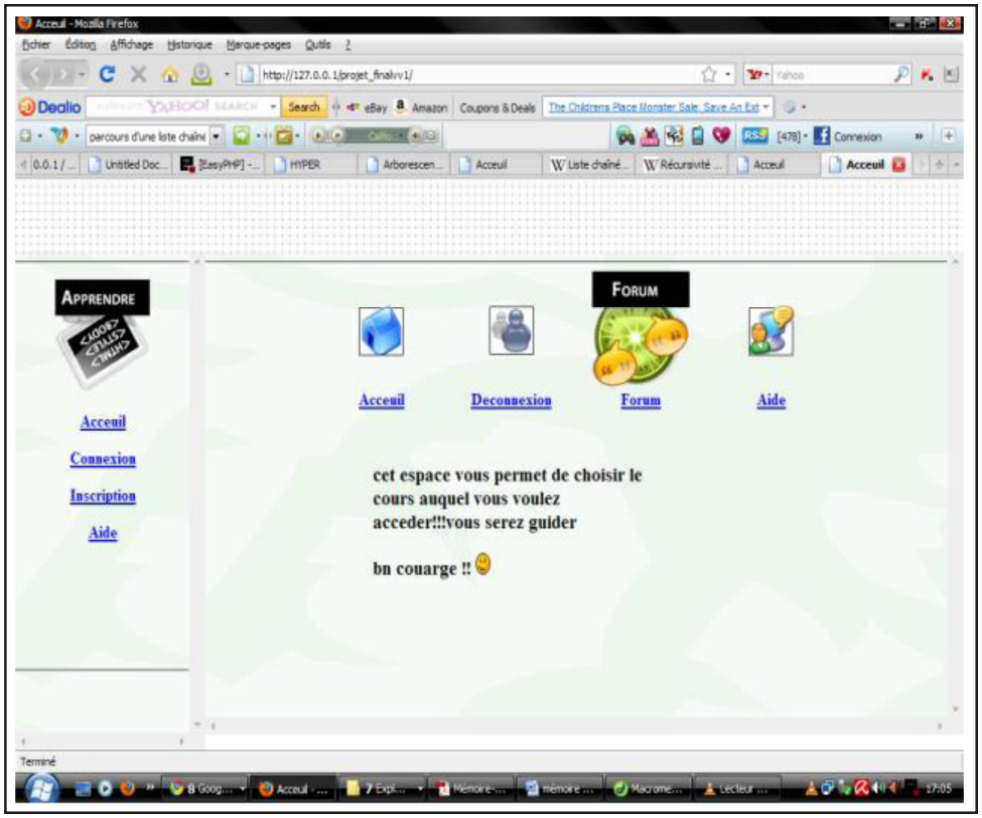

Figure 6. Home page

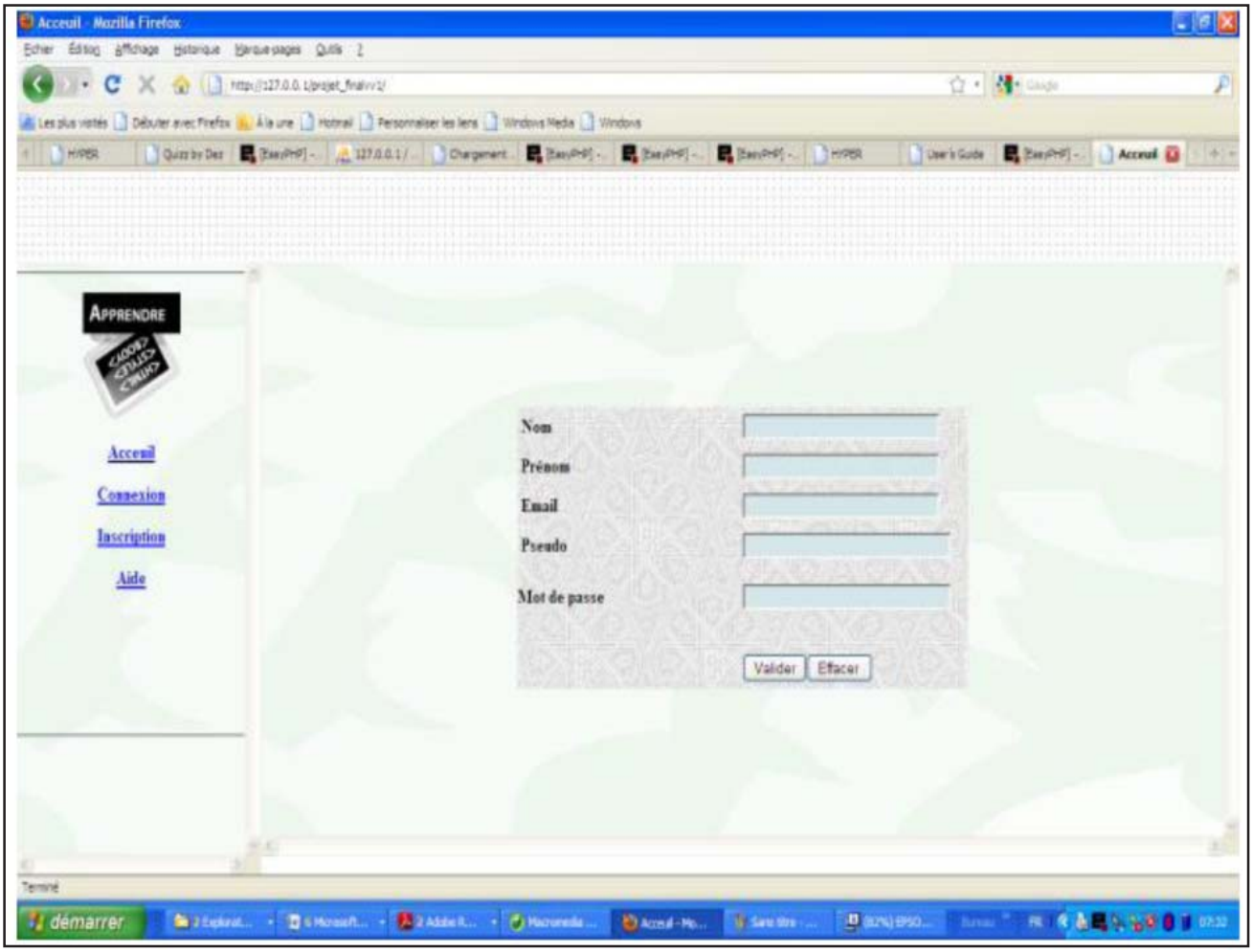

Figure 7. Subscription page

• The conditional precedence relation

*N*1 concept is conditional precedence relation with a concept if *N*2 control (possibly partial) of *N*2 is necessary to learn of *N*1. This relationship has an attribute *S*, which represents the minimum level of control *N*2 to allow early learning *N*1.

• The relation of sufficiency

*N*1 concept is related with a concept in a relationship of sufficiency if control of (possibly partial) causes (possibly partial) control of *N*1.

This relation has two attributes, noted by *S* and *A*:

S is the minimum level of control of *N*2 to activate the relationship of sufficiency.

A is the contribution (in proportion) of control *N*2 to *N*1.

To make the task of adaptation we will have to go through two steps that are essential graph generation and later generation paths. [2]

3. Approach Followed

The process followed to achieve our approach is composed of two parts:

The first is to generate the graph and the second is to find the graph obtained from the different paths leading to the goal.

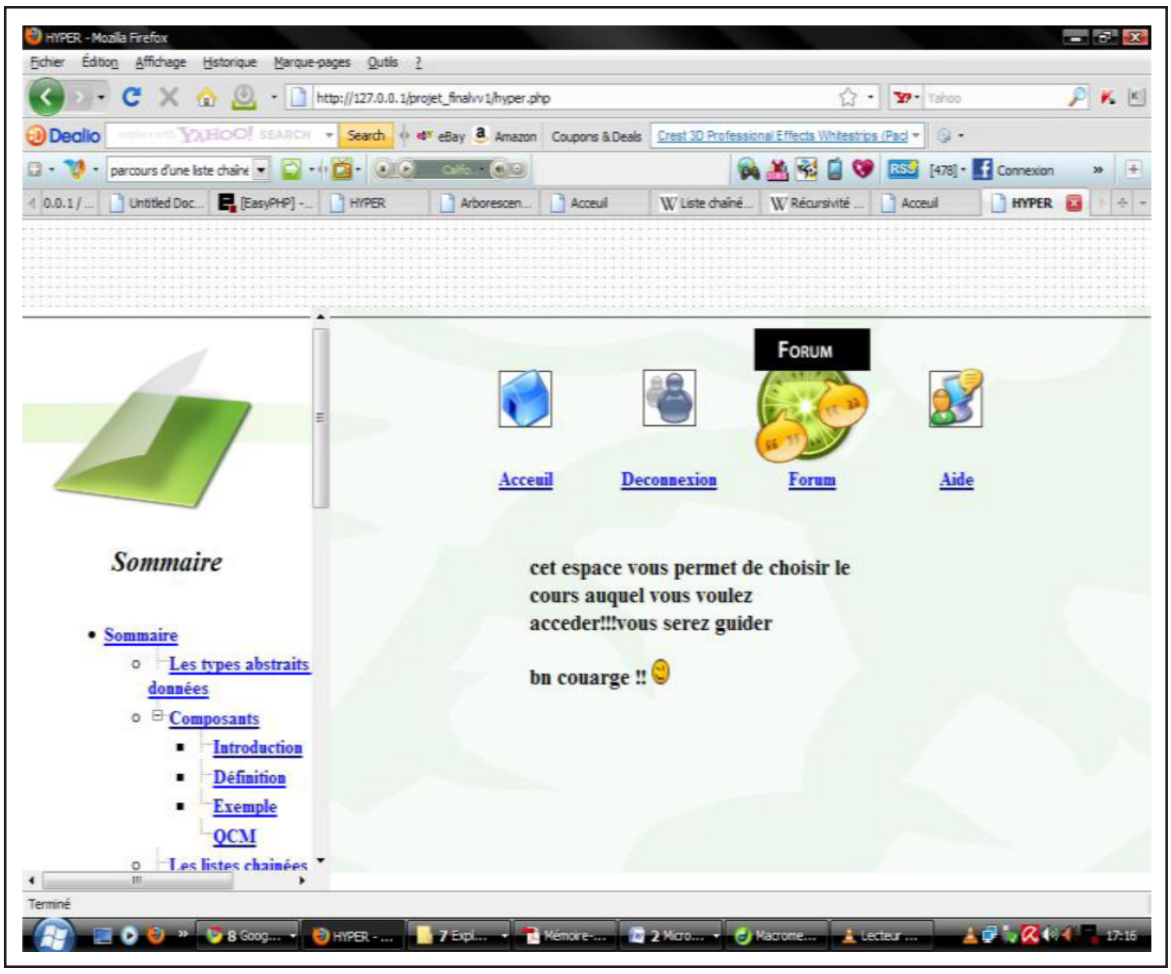

Figure 8. The hypermedia

3.1 The generation of the graph

The graph generation is to reduce the navigation space of the learner in order to limit the cognitive load to avoid the disorientation. From the domain model and learner model, the graph generator module will find a graph of concepts and then generates the different paths that lead towards the goal.

A path of concepts *C* is a sequence of concepts of a network such as the order of concepts respects precedence relationships and in a relationship of sufficiency of these concepts in the network (graph).

The generation of graph concepts can be divided into several consecutive steps.

Step 1: Representation of the initial state of the learner model:

On the left side of the figure is represented the network of domain concepts. To simplify the diagram, we chose to label the concepts through letters.

A concept is checked: it is a concept defined by the learner as the learning objective of the session.

This concept is the first that we will include in the graph of concepts.

On the right is shown the network of concepts stored in the learner model of the learner. It is a vision at a time t of the learner's mastery of the concepts in the field.

Step 2: Concepts directly above the objective concept of learning that are not present in the learner model are added to the

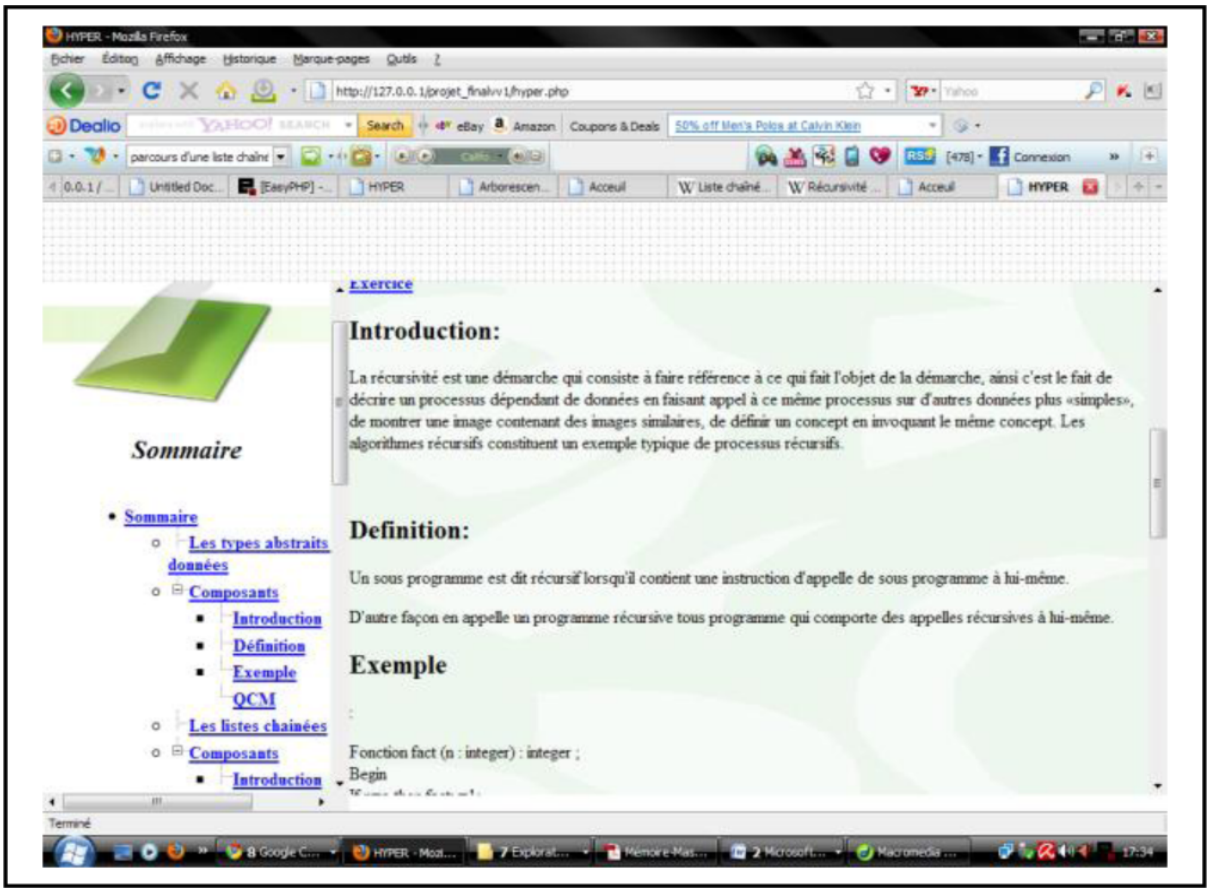

Figure 9. The course page

graph of concepts.

If these concepts are present in the model of the learner but the master of these concepts is below levels of conditional precedence among these concepts and concept learning objective, they will also be added to the graph of concepts.

This step is repeated recursively until reaching concepts sufficiently controlled by the learner or until all the leaves of the graph of the concepts have no precedent (*s*) concept (*s*). [2]

Step 3: the use of relations of sufficiency.

In the example, the concepts (*i*), (*n*) and (*o*) were added to the graph of concepts. Indeed the control of (*i*) was below the threshold in a relationship of sufficiency of the relationship between (*i*) and (*f*) (learning objective). The master of (*n*) and (*o*) are zero in the model of the learner.

If one of the concepts added at this stage some are targets of a precedence relation with concepts not sufficiently mastered by the learner, then these concepts are added. In this case the algorithm returns to step two. [2]

Step 4: The graph of concepts is complete when all the leaf concepts (ends) of the graph of concepts are sufficiently mastered by the learner.

3.2 The generation of paths

This module will therefore help to find the different possible paths that can lead to the target set by the learner during the session of learning.

The problem becomes how to find a way through a graph?

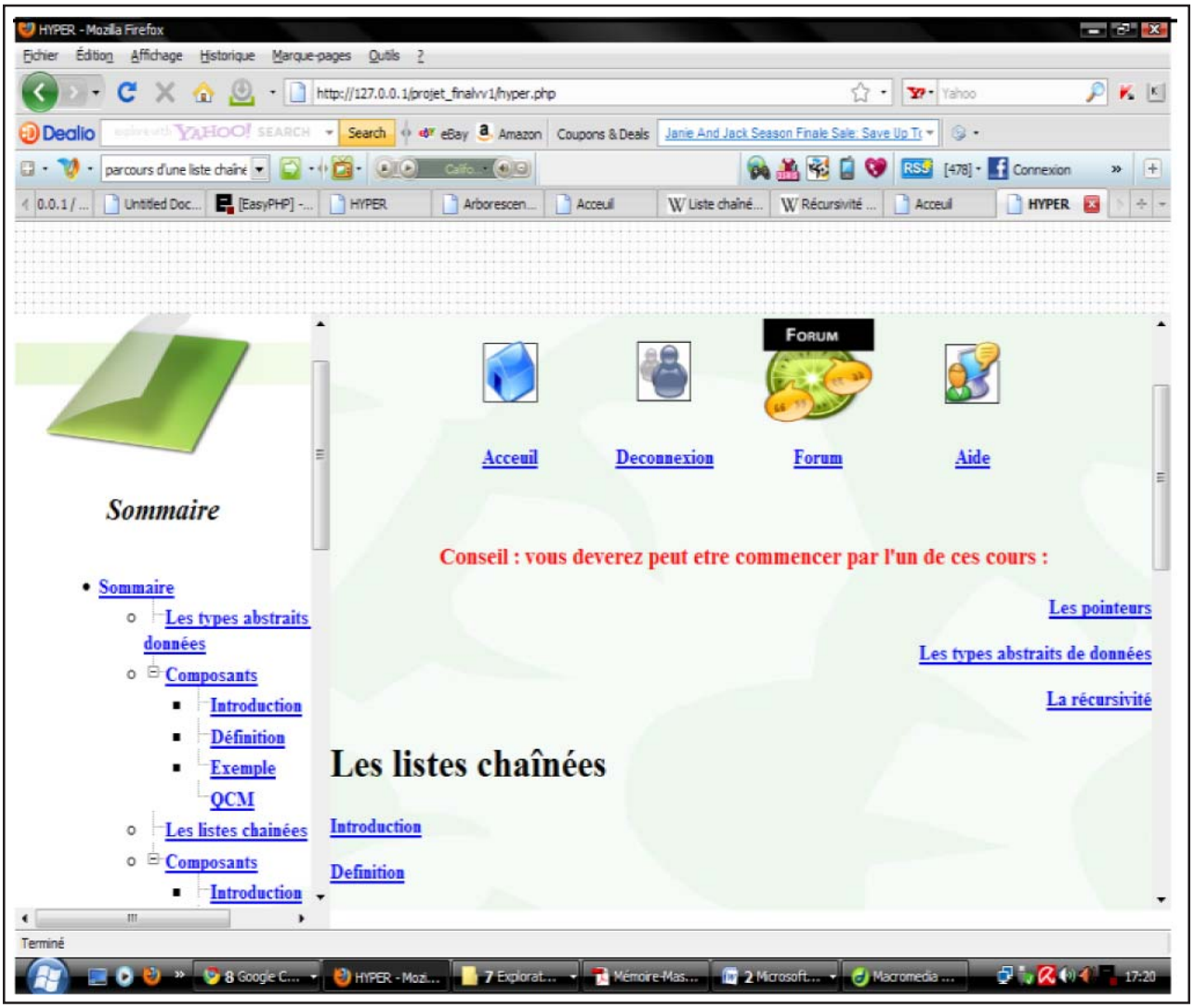

Figure 10. The course proposed

The procedure was as follows: From the objective, it follows a path from the nodes as far as possible by marking them as and when as they are meeting. When the end of path is returns to the last election and it takes another direction to get a new one.

The algorithm ends when all vertices have been visited. As a result we obtain all paths possible to achieve the previously set. The learner can then borrow one as he wants.

4. HYPERSURF

After introducing the approach conceived for the adaptation of the navigation in a hypermedia, we present in this point the realization of our approach.

The heart of any adaptive system consists of a domain model and model learner.

4.1 Welcome page of HYPERSURF

The first component provides overall structure of the hypermedia document and determines the different variations of the elements that constitute it and their relationships. It is also known as a conceptual structure or domain knowledge and is usually implemented using hypermedia pages.

The learner model allows learners to take into account the different characteristics of the learner's, such as personal

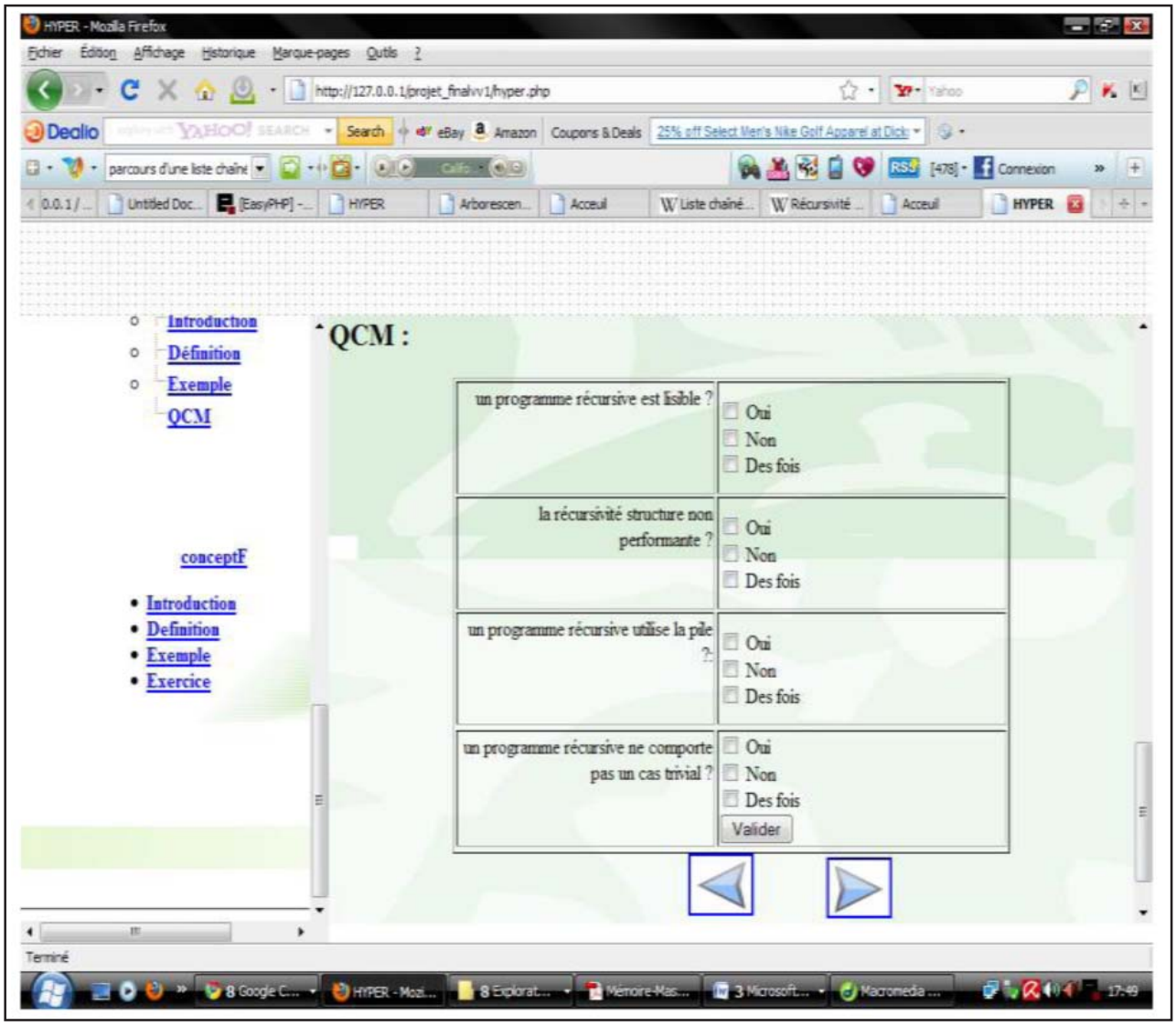

Figure 11. The evaluation by a MCQ

characteristics and goals teaching, and especially its rate of assimilation.

The interface module is responsible for adaptation of content and interaction with the learner.

It also consists of a multimedia database that stokes necessary informations about learners and courses. .

We take the two models (learner model and the domain model) to which we add a graph generator module used by the module path generator to determine the paths concepts.

Easy to use, our system offers to learners a means to document and train themselves. The intelligent aspect of our system is in adaptation and generation of links depending on the specific characterizing the learner.

For the realization of this approach, a prototype was made and we call it HYPERSURF, these are some interfaces:

4.2 Subscription

The learners already subscribed can open their sessions with an identifier and a pass word, else in the case of a new user, he opens a new session by completing a form.

4.3 The hypermedia
The learner can access to the hypermedia which contains the courses offered.

4.4 Vizualisation of the course
The learner navigates through the hypermedia by choosing a course from the summary.

4.5 The adapted course
Displayed performing the task in adaptation. The system displays to the learner as and a measure of its navigation a set of links from which the learner can start surfing.

4.6 The evaluation
Students are assessed through a questionnaire multiple-choice (MCQs), they will be required to answer on proposed QCM for each course, after validating their responses, a dialog box appears containing note and a comment.

5. Conclusion

Adaptive hypermedia offers to learner the optimal knowledge wich is the most adapted to his profil. This work improves the quality of adaptation and reduces the two interrelated classics major problems that are cognitive overload and disorientation by an adaptation of the navigation. This adaptation is done by posting the links to each learner in a personalized way according to his profile.

Our approach for design and develop a hypermedia system to adapt the navigation to the learner model ,initiate some prospects for this system, for example:

As an extension, we plan to experiment more fully our study and the improvement of all adaptation methods covering computer or other disciplines.

Vis-à-vis human nature any adaptive system has been unable to adapt it to the human nature which has not be identified. Use another method of adaptation of the presentation to provide a better quality of adaptation. Consider the model learning preference.

References

[1] Delestre, N. (2000). Un hypermédia adaptatif dynamique pour l'enseignement, Thèse au laboratoire PSI de l'université de Rouen.

[2] Hafidi, M., Besebaa, T. Intégration d'un tuteur intelligent avec un hypermédia adaptatif dynamique une approche fondée sur des ontologies.