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Flexible navigation for the pedagogical hypermedia design and evaluation improvement

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Abstract: We are working on a method, called CEPIAH, for the design and the evaluation of pedagogical hypermedia. We propose a web based system used to help teachers to design hypermedia documents and to evaluate their prototypes. Having already elaborated a methodology for the evaluation of interactive pedagogical hypermedia (EMPI), the experience and the acknowledgement we have is able to upgrade the design help. To help the designer in his instructional Web site creation we developed an interactive guideline accessible on the Web. Three modules compose the guide: Evaluation Help, Design Help, and Predefined Models. We present as it follows a short description of the first and second modules.

1. Introduction

Nowadays, we find more and more e-learning applications on the Web. Our research complies the pedagogical hypermedia environments design and evaluation: What are the design and development stages for a pedagogical hypermedia product? How to design ergonomically an educational Web site? What are the graphic design elements to be taken into account for pedagogical hypermedia? To answer these questions we need tools for the design, characterisation and evaluation of the learning hypermedia product.

Using the data and the experience achieved in our previous projects, EMPI (see Hû 2001) and SP/UL/FC (see Crozat, 2002), our current research objectives are to create a methodology to sustain the educational hypermedia design and evaluation: the CEPIAH project (Conception and Evaluation of the Interactive Pedagogical Products). We develop an interactive Web guide consisting of three modules: Design Help, Evaluation Help and Predefined Models. The objective of these interactive environments is to help the educational web sites authors in their design and prototypes evaluation.

In this paper we present the global structure of our system followed by our work on the conception and evaluation help assistance for the pedagogical hypermedia environments. We conclude with the further prospects of our research for design of the third module, Predefined Models.

2. Cepiah Method

In order to guide and help the educational Web sites authors in the conception/evaluation process of their prototypes, it is especially interesting to propose them interactive guides. Among the existent interactive guides, only few offer a good content structure or an appropriate navigation in their system. For example, the sites CINEMA (CINEMA, 2000) and W3 Educatif (W3 Educatif, 2001) consist mainly of a section "Course" and of a section "Evaluation" such structure doesn't facilitate the navigation between these parts during the conception process. We propose a

method for the design and evaluation help for the educational hypermedia having the following characteristics: the flexible navigation in the environment improving the iterative conception/evaluation process, and an offer of predefined models of educational web sites.

2.1 Structure

We gathered all the information that we want to take into account in a knowledge base, with a hierarchical tree structure, based on: themes, meta-criteria and criteria (Figure 1). We propose this structure because we are not interested only in the « ergonomic » aspect, but also we are interested in the technical quality and the pedagogical structure etc. That's why we introduced the notion of "theme". Furthermore we think that choosing this structure enables a « finer » content division (« chapter », « section » and « paragraph » type like) in order to respect the Humain-Machine Interface ergonomic rule of « maximum three clicks ». That will improve the legibility and will help an educational hypermedia designer to guide himself during his conception and evaluation work. The themes position in this structure is at the highest level. Each meta-criteria consists of criteria. We identified six main themes:

The **Project Management** theme determines the design and development stages for a pedagogical hypermedia product. Thus, the meta-criteria decomposing this theme deal about a previous analysis (demands, tasks file, necessity analysis etc.) on the juridical and financial aspects of design procedure for a teaching hypermedia product.

The **Technical Quality** theme regards the soft elaboration: fastness, compatibility, download etc. Finally, for a pedagogical Web site good utilisation, the user should not encounter technical problems due to certain miss functions of the system. So, the educational site designer must consider the technical aspects as: an image downloads time, a document or application download.

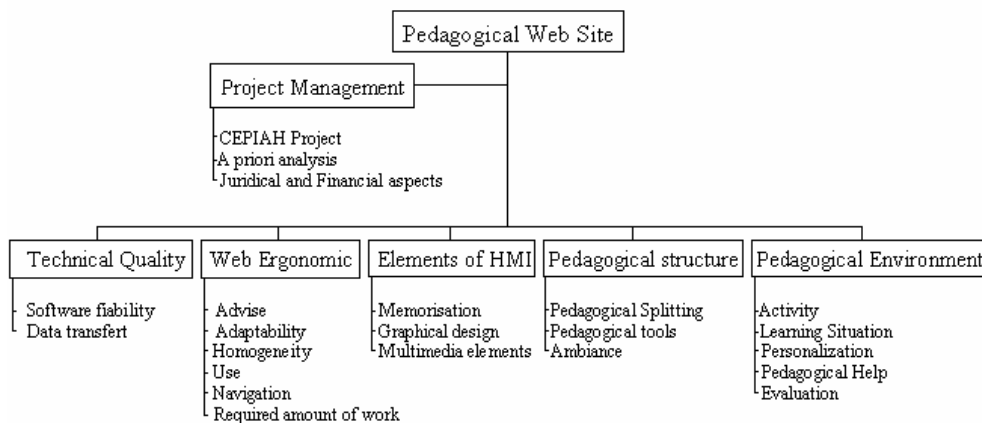


Figure 1. Global structure

The **Web Ergonomic** theme gives the general instructions for an ergonomically design of IHM (Human-Machine Interface) and the Web sites. Among the meta-criteria this theme consists of, we remind: the manoeuvrability, the guide through out, the navigation, etc. To identify these suggestions we inspired ourselves from the works of (SCAPIN 1997), (NIELSEN 2000), (VANDERDONCKT 1994), (VANDERDONCKT 98).

The theme: **Elements of Human Machine-Interface** deals with the graphic design elements and multimedia elements (such as image, sound etc.). These elements should be the most adapted for a pedagogical hypermedia. Therefore, the indications cover the aspects of graphical presentation (colour, typography, icons etc.), of text elements (tables, lists etc.), the most used in learning hypermedia environment. The indications about the sound, image and video integration, are equally covered by this theme (NIELSEN 2000) (PREECE 1996).

The **Pedagogical Structure** theme concerns the presentation quality, the content structure and the pedagogical tools (reading tools, interactive tools) appropriate to an hypermedia learning environment. Finally, the content structure must highlight the main logical lines and the main links between various content elements. At this level the different structuring techniques are a priority. The schema facilitates the perception, the comprehension, the memorisation and in conclusion the learning process (BRUNER et al. 73).

The **Pedagogical Environment** theme concerns the instructions upon the pedagogical multimedia characteristic elements such as, the suggested pedagogical activities for the learners and also the tools that enable the communication, the evaluation and the supervising of the learners during the instruction process (DEPOVER 1998).

2.2 Design help

A methodology (SP/UL/FC) for the pedagogical hypermedia supports design has been developed during previous researches in the period September 1999 until September 2002 (CROZAT 2002). The objective of these researches was to find of an original approach, which, based on the supports characteristics analysis, suggests an appropriate digital supports exploitation in the pedagogical practice. This approach is based on an information representation model, for the Logical Units case, and on a logical conception that enables the effective information representation using a given support.

The part concerning the module for the design help of an educational web site is structured on an atomical ensemble further called *information units*. According to (CROZAT 2002), an information unit corresponds to the whole contents available in a learning frame. In our model we imagined a course structure based on this principle (see figure 2). So, in this structure the body of every unit consists of elements of several text blocks. A text block is an information unit of three elements: definitions, detail accuracy, example lists and annexes. The definitions describe the recommendations to be considered by the course author during the conception process. These recommendations correspond to different domains such as: IHM ergonomic, pedagogical multimedia environments etc. The detail accuracy provides a detailed view for each recommendation of the course. The figure 2 shows an atomic course information concerning the Graphical Presentation of the meta-criteria Graphical Design.



Figure 2. Atomical information

The examples can show what the author should avoid- negative examples and/or what he has to consider during his course conception - positive examples. To illustrate, we present as it follows a negative and a positive example (figure 3), connected to the course atom Graphical Presentation. The annexes reveal information about the used sources for a module of educational Web sites design help and extra references on request.



Figure 3. Negative example (a), positive example (b)

2.3 Evaluation help

The evaluation module consists of interactive questionnaires associated to the themes presented in the conception help section. The questionnaires are accessible on-line on the CEPIAH web site.

An important feature of our questionnaires is the explication it gives to the evaluator. Thus we can notice three different information levels that can be use for evaluation: the explanation of each theme and of each meta-criteria, the new-formulation of the question and references to theoretical points and bibliography of the subject (figure 4). It's important these helps in the most neutral manner possible, in order to guide the evaluator to formulate his choice without influencing him.

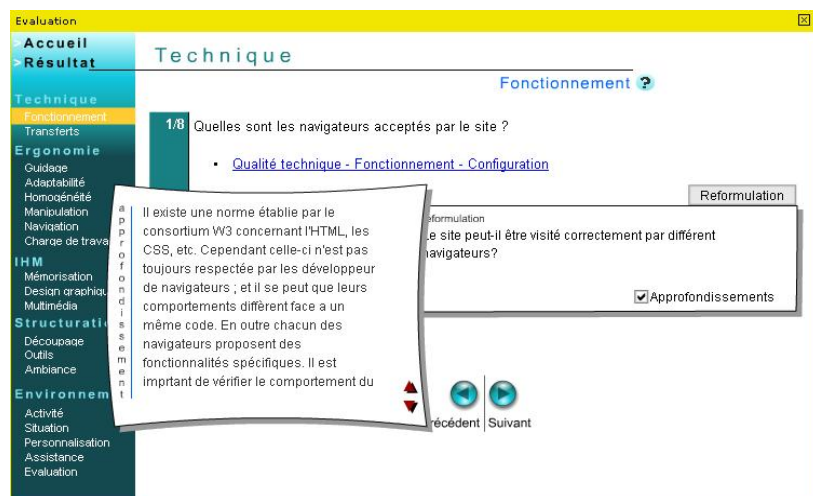


Figure 4. Example of question with new-formulation

For this module creation we used the results obtained by the EMPI methodology. EMPI is a soft made between 1997-2001, for the interactive multimedia soft evaluation using the dynamical navigation through a set of questions (HÛ 2001). This methodological environment had been conceived to assist the designers in their prototypes evaluation or to guide the teachers to made up their choice on the multimedia didactical soft.

2.4 Flexible navigation

We propose a "both way" navigation in order to reduce the eventual disorientation in our interactive guide and in order to help the user to evaluate and to modify, if required, their prototype.

Concerning the Evaluation section, the questionnaires are structured with a flexible navigation enabling the evaluator to have permanent access at the design section by the existing links between the two sections of the site at the themes and meta-criteria level. The Conception section also enables the user to navigate through different evaluation questionnaires using the indirect links that exit at the themes and meta-criteria level. The figure 5 shows the course atom of the Pedagogical Divisation meta-criteria from the Pedagogical Structure theme (the Conception section) and also the available link towards the Evaluation section of the same meta-criteria.



Figure 5. Navigation between two parts: Conception and Evaluation

For instance in the figure 6, we show the explanation on the Pedagogical Divisation meta-criteria of the Pedagogical Structure theme from the Evaluation section. We notice the links towards the atomic information of the same meta criteria from the Conception section.



Figure 6. Navigation between the Evaluation and Conception sections

Based on each questionnaire evaluation results, our system proposes a synthesis for each question and also a navigation possibility at *criteria* level, towards the Conception section. Especially for the faint evaluation results we advance the idea that this synthesis can help the user to understand and to improve the defects in his prototype.

3. Conclusions and perspectives: towards predefined models of educational web sites

We are now working on a third module proposing predefined sites models. The module consists of three sections: help, models and images library. The "help" provides specifications about the site functioning. The second section proposes predefined site models that the authors may download and customise at will. The customising concerns the course structure, projects, laboratories and also the content division and site navigation. The images library is useful for the site models customising. At the present the proposed models (Figure 8) depend on the users informatics competence («beginner» level or «intermediate» level).

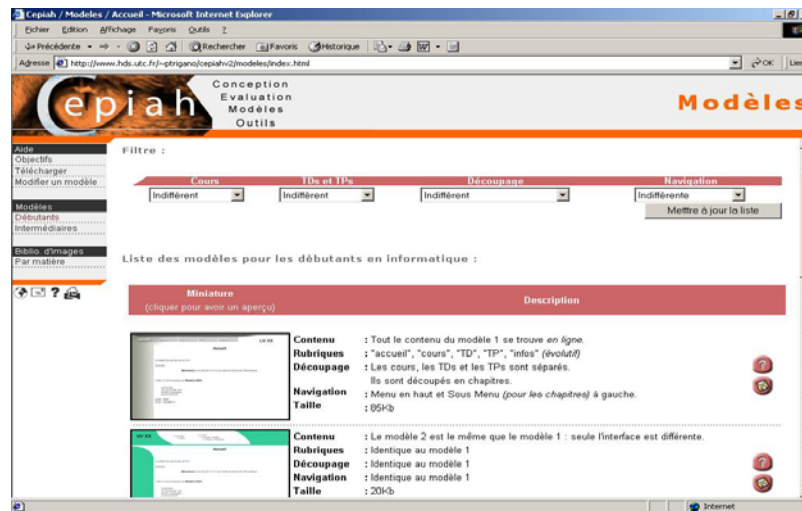


Figure 7. Predefined models of pedagogical web sites

For the moment, we continue to develop this module, directing our research to the pedagogical scenarios design, starting from the learning theories fundamentals (GAGNE, 1996) and also the Instructional Design Theories, using the current research results of D. Merrill (Merrill, 1999) and C. Reigeluth (REIGELUTH, 1999).

We expect soon a first validation of the interactive guide by the third year engineer department students of UT from Compiègne (France) in a short term. They will conceive educational web sites for several courses in the university. The results of this validation will enable us to find the weaknesses of our prototype and to ameliorate them.

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