Facilitating the Comprehension of Online Learning Courses with Adaptivity

S. Lippitsch

University of Education, Kunzenweg 21, 79117 Freiburg, Germany
lippitsc@ph-freiburg.de

Abstract. Knowledge acquisition with texts is assumed to be a process of building a mental model of the specific subject. For readers with more prior knowledge, the building of an accurate mental model is easier because they do not have to establish a new structure. Readers with less or no prior knowledge might build an inadequate mental model of a subject. In a hypertext learning environment this could be prevented by several adaptive features that support the user with additional information. We plan to examine the effectiveness and efficiency of such adaptive features within an online course by assessing the user's acquired domain knowledge, the user's satisfaction, and achievement of the user's objectives.

Text Comprehension in Hypertext

As a first step towards improving the user's comprehension of hypertext learning courses, one has to analyze reading comprehension processes. According to Storrer [1], an author of learning courses has to design them especially to facilitate the user's comprehension. For an integrating theory, Storrer suggests a model of Schnotz [2], which she stated to be especially adaptable for the use in knowledge transfer with hypertext, although it is designed for linear text only. It assumes the building of a mental model to be the central element of the comprehension process. The user's mental model of the learning object is built through an interaction between the already acquired knowledge and the actual text information.

In contrast to linear text, one of the main features of hypertext is to provide the user with opportunities to jump to different anchors or pages even within another context. Due to this distributed nature of hypertext, following links may confuse the user about the contextual linkage between pages. Thus, the level of prior knowledge may be crucial for text comprehension: when a novice user jumps to advanced pages, he or she is in danger of building a mental model in a way the author did not intend to. In our approach, the user's knowledge acquired within the course will be taken into account to limit this effect by providing him or her with hint texts, representing brief summaries of and links to background concepts the user does not have sufficient knowledge about. With this help, users with less or no prior knowledge should be able to build a more coherent mental model of the course subject.

Project Description

The project aims to examine different ways of facilitating the user's comprehension of online learning courses. All approaches are based on the adaptation of the page presentation to the user's prior knowledge, acquired either within the course or beforehand. Here, we use the expression 'prior knowledge' for the knowledge state on prerequisite pages within the course. In contrast, 'background knowledge' is the topic related knowledge at the beginning of the course.

Our first attempt to comprehension enhancement is the presentation of adaptive coherence information to users who did not learn prerequisite pages within the course. Coherence means the connectivity between the pages regarding the overall topic. As a future option, the user may mark the referred pages manually as already learned outside of the course. The system may then update the user model and would no longer present hint texts of these pages.

Second, there may be differences in the usage of an online learning course regarding the user's goals of information retrieval. One user may use the course as a reference, just to look up some currently important detail, while another user may want to learn the whole course. The system may present the course differently to these user groups by focusing on either the search features or the text coherence features.

Finally, a decision between the presentation of more detailed or more brief texts to novice users may be made by presenting long or short text fragments to novice users experimentally. Theoretically, both methods are reasonable.

First Step: Adaptive Coherence with hint texts

Our first approach to comprehension facilitation is to add coherence to a hypertext learning course. This was first realized by Foltz [3]. He introduced a system that presented some additional but non-adaptive coherence information if the user followed a link that lead far away from the actual page. His additional coherence information consisted of short summaries of those pages the user just skipped. The summaries were presented on top of the page the user jumped to. That means, there were no summaries presented on pages closely related to the one he or she just left (e.g., parents, children, siblings).

As Foltz mentioned himself, one complication in his study may have been that many users went through the course in a coherent way, just rarely producing any summaries at all. The reason for this user behavior may have been their lack of background knowledge at the beginning of the course. To have even novice users navigating through a course in a non-coherent way, we chose to use an existing HTML-course. A pilot study demonstrated that a not inconsiderable fraction of users jump between pages in a non-coherent way.

However, in contrast to Foltz, hint texts should only be presented to users with less course knowledge, because users with a higher level of course knowledge may get distracted by additional information (e.g., [4]). Therefore, we propose to present the hint texts individually, depending on the knowledge about prerequisite concepts from within the course.

In NetCoach [5], which we use as underlying authoring system and online server, the domain model consists of prerequisites and inferences. One page (A) is called a prerequisite for another page (B), if page A has to be learned before page B is visited. The user model consists of the knowledge states of all course pages.

We want to provide the user with additional coherence information about important (i.e., prerequisite) pages he or she does not yet have knowledge about. This is accomplished by presenting additional hint texts and links on top of the requested page. Each hint text is a short sentence on the basic topic of one not yet learned prerequisite page. These additional texts are not meant to substitute the original pages, but to hint to important reference pages. Thus, next to these texts a link is arranged to access the referred page. As a further step, we are planning to use a pretest to take into account the background knowledge biasing the knowledge states in the user model.

In summary, the system improves the coherence of the text flow by presenting hint texts and links to pages which could provide the necessary knowledge for sufficient comprehension of the current page.

Experimental Evaluation

We expect that users will profit from the additional coherence information resulting in a better exercise performance and better satisfaction and achievement of objectives than those users without the additional information.

We are planning an evaluation of the new coherence feature in several subsequent steps. The first step will be to assess the use of the hint texts in general, i.e. whether users actually follow the additional links. The second step will be a field experiment in which the users would be assigned to different conditions randomly. The user's exercise performance and the satisfaction will be assessed and compared between these groups. We expect to find a better performance and satisfaction in the group with the hint texts. The third step will be an offline laboratory experiment. The advantage of such a setting will be the reduction of the setting condition variability and thus to be able to attribute the difference in exercise performance directly to the different hint text presentations.

References

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