Combining Individual Tutoring with Automatic Course Sequencing in WBT Systems

Denis Helic
IICM, TU Graz
Inffeldgasse 16c
8010 Graz, Austria
dhelic@iicm.edu

Hermann Maurer
IICM, TU Graz
Inffeldgasse 16c
8010 Graz, Austria
hmaurer@iicm.edu

Nick Scerbakov
IICM, TU Graz
Inffeldgasse 16c
8010 Graz, Austria
nsherbak@iicm.edu

ABSTRACT

Usually, the success of systems using automatic course sequencing depends strongly on careful authoring and foreseeing of all curriculum alternatives before any learning session even starts. We believe that tutors, starting from a simple generic curriculum, and assuming that they have the proper tools, can much easier create curriculum alternatives as immediate response to the current learning situation. In this paper we present a tool that provides a flexible environment for tutors allowing them to customize, and develop the curriculum on-the-fly. However, since individual tutoring is quite expensive we shortly discuss possibilities for enabling automatic adjustment of course curriculum to learners' needs by combining on-the-fly curriculum alternatives created by tutors with well-known automatic course sequencing techniques.

Categories and Subject Descriptors

H.5.4 [**Information Interfaces and Presentation**]: Hypertext/Hypermedia—*Navigation*; K.3.1 [**Computer and Education**]: Computer Uses in education

General Terms

Experimentation, Human Factors

Keywords

WBT, tutoring, course curriculum, course sequencing

1. INTRODUCTION

The basic learning scenario in Web-based training (WBT) systems involves three user roles: authors, tutors and learners. Authors, who are usually experts in a particular subject matter, i.e. they possess a good knowledge of that domain, prepare a number of courses and publish them on the system. Afterward, learners access the published courses to acquire the desired new knowledge. Tutors usually only supervise learners during their learning sessions, and answer their questions about the presented learning material.

The learning curriculum in such a scenario is determined by the navigational structure of a particular course. Usually, this curriculum is a rather generic curriculum that is created by authors for a wide range of learners and does not take into account the specific needs of a particular learner [3].

There exist a number of approaches to overcome this drawback in WBT systems. Usually, all of these approaches deal with different methods for customizing the course curriculum to learners' needs. For example, pre-learning tests might be applied to assess the knowledge level and cognitive style of a particular learner. At the next step this information is used to select the appropriate course curriculum among a number of alternatives predefined by course authors [5]. Other possibilities for improving curriculum customization include adaptive hypermedia system techniques such as adaptive navigation support [2], or intelligent tutoring systems techniques such as dynamic course sequencing [3]. These techniques are based on sophisticated learners' models reflecting their knowledge and cognitive style and a number of sequencing rules that are used to dynamically infer the appropriate course curriculum.

Although all of these techniques represent powerful customization mechanisms we believe that they also have certain limitations. Basically, these techniques are based on two important preconditions. The first precondition is the proper assessment of learners that is crucial for creating the appropriate learner model. The second precondition is the proper identification of relevant curriculum alternatives or the proper definition of course sequencing rules. Both of these preconditions need to be identified by authors before any learning session starts. This can be seen as a quite complex, and one of the most challenging tasks in applying such techniques. Usually, the success of systems using the above mentioned techniques depends strongly on careful authoring and foreseeing of all possible learning situations, or curriculum alternatives [4].

However, we believe that tutors, assuming that they have the proper tools, can much easier customize the starting generic curriculum as immediate response to the current learning situation. Thus, they can tailor the curriculum to the specific needs of each particular learner on-the-fly. For example, tutors may extend the starting curriculum by linking to external Web resources, learning material residing on their local sites, etc.

In the next section we present a tool called Virtual Classroom that was implemented as a part of the WBT-Master system[7]. This tool strongly emphasizes the tutors' role in the learning process by providing a flexible environment for tutors allowing them to customize the curriculum on-the-fly.

WWW2004, May 17–22, 2004, New York, New York, USA.
ACM 1-58113-912-8/04/0005.

2. VIRTUAL CLASSROOMS

Virtual Classroom consists of two major components: the library of learning resources and course curriculum. Learning resources can be of any type. For instance, the courses available in the system, simple documents, and Web resources can all be a part of the library. On the other hand, the course curriculum is a description of a particular learning session. Thus, the curriculum explains what actions should be performed by learners and in which sequence in order to achieve a particular learning goal.

Basically, tutors work all the time just with the curriculum and classroom library. Thus, at the beginning of each learning session tutors create the starting curriculum and select a number of learning resources for that curriculum. As the learning session progresses they might need to modify the curriculum and/or the classroom library to adjust it to the current learning situation.

Technically, this approach follows closely the SCORM simple sequencing model [1]. Thus, the classroom library provides learning content, which is then sequenced by means of the course curriculum. The principal difference of our approach compared with other similar approaches is in the way how the course curriculum is developed, namely by tutors as a response to current needs, questions, or requests of their learners.

The Virtual Classroom tool was developed within the scope of the CORONET project. The corporate application partners deployed the tool for the on-the-work training of the work force. They also evaluated the tool considering the learning effectiveness, cost/benefit ratio, usability, etc. The evaluation results were quite positive [8].

3. EXTENDING VIRTUAL CLASSROOMS

The positive cost/benefit ratio of the Virtual Classroom tool is easily understandable. One of the evaluation partners was a software training and consulting company offering face-to-face training in the classical classroom settings. By using the Virtual Classroom tool they were able to replace some of their face-to-face sessions with online sessions, and save for instance travel expenses in this way.

However, individual tutoring is usually quite expensive and many organizations are not able to cope with the new costs resulting from such an approach. For example, the costs of individual tutoring at colleges or universities are extremely high, and obviously this approach can not be applied in such organizations.

Therefore, we suggest combining the above described individual tutoring approach with automatic course sequencing techniques. We hope that with such a combination we can achieve better results in automatic adjustment of course curriculum to the current learners' needs. This can be achieved because, in our approach, curriculum customization is not based on curriculum alternatives, or sequencing rules made by authors before any learning session started. Rather, the customization process is based on decisions made by tutors during the previous learning sessions.

To implement this functionality a similar mechanism to that used in active documents can be applied [6]. Active documents can be seen as a viable alternative to pre-made question/answer (Q/A) documents. In the case of pre-made Q/A documents (e.g. system help documents) authors need to foresee all possible questions that can be made by users of a particular system and provide answers to those questions. On the other hand, in the case of active documents questions are answered on-the-fly by an especially designated user. Of course, special mechanisms are implemented allowing that after some of the questions are answered manually all other questions might be answered automatically [6]. These mechanisms include text classification algorithms to determine the similarity between questions, semantic analysis of text, collaborative filtering algorithms to make use of similarities in user profiles, etc.

Similar approach can be taken in curriculum customization. Thus, at the beginning the system is "trained" how to react in certain situations. For example, curriculum alternatives made by tutors are recorded together with the state of the user profile for which these alternatives were made. Collaborative filtering algorithms for analyzing learners' profiles may be applied to select an appropriate alternative among all alternatives recorded by tutors. Thus, for a particular learner the system can select exactly that alternative, which was created by the tutor for learners with "similar" learner profile. Further, questions asked by learners are recorded and classified using text classification algorithms. Now, whenever new learners ask a question, that question can be checked for "similarity" with the previous questions. The curriculum alternative made by the tutor as a response to one of the "similar" questions can be selected as the system response.

To insure interoperability with other tools and systems we plan to base this extended Virtual Classroom tool on open standards, such as SCORM.

4. ACKNOWLEDGMENTS

The future work on the Virtual Classroom tool will be funded by the European Commission within the project called Network of Excellence on Digital Libraries (DELOS).

5. REFERENCES

[1] ADL. Scorm - sequencing and navigation, version 1.3, 2004.

[2] P. Brusilovsky. Adaptive navigation support in educational hypermedia: The role of student knowledge level and the case for meta-adaptation. *British Journal of Educational Technology*, 34(4):487–497, 2003.

[3] P. Brusilovsky and J. Vassileva. Course sequencing techniques for large-scale web-based education. *International Journal of Continuing Engineering Education and Lifelong Learning*, 13(1-2), 2003.

[4] P. DeBra. Pros and cons of adaptive hypermedia in web-based education. *Journal on CyberPsychology and Behavior*, 3(1):71–77, 2003.

[5] J. Hasebrook. Learning in the learning organization. *Journal for Universal Computer Science*, 7(6):472–487, 2001.

[6] E. Heinrich and H. Maurer. Active documents: Concept, implementation and applications. *Journal for Universal Computer Science*, 6(12):1197–1202, 2000.

[7] D. Helic, H. Maurer, J. Lennon, and N. Scerbakov. Aspects of a modern wbt system. In *Proceedings of SSGRR 2001*, L'Aquila, Italy, 2001. SSGRR.

[8] S. Trapp. Coronet project - final report. Technical Report IST-1999-11634, Fraunhofer IESE, 2002.