An Authoring System for Instructionally Designed Tutoring Processes

Alexander Seitz*, Matthias Dannenberg*, Hubert Liebhart§
*Dept. of Artificial Intelligence, University of Ulm, 89069 Ulm, Germany,
{seitz,dannenberg}@informatik.uni-ulm.de
§Faculty of Medicine, University of Ulm, Albert-Einstein-Allee 7, 89081 Ulm,
hubert.liebhardt@medizin.uni-ulm.de

Abstract

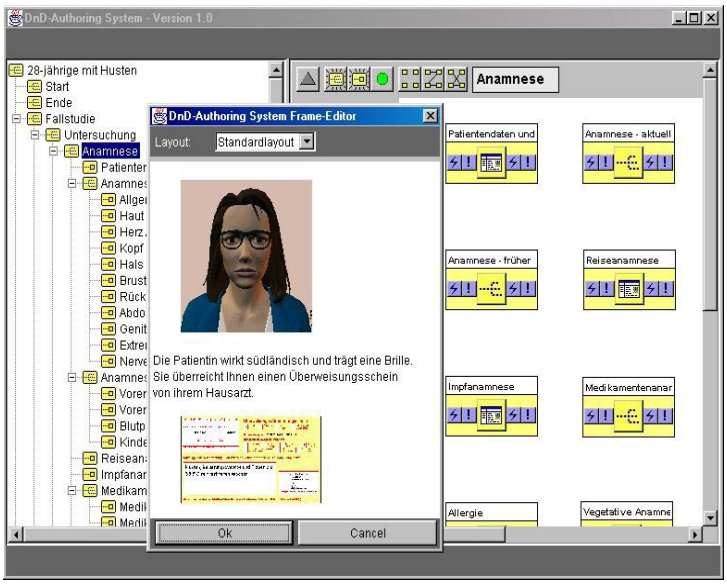
This paper describes the design and implementation of a domain independent authoring tool for tutoring systems. The presented work incorporates standard authoring features, including a hierarchical development of learning material, but also supports users in a didactically suitable design of the tutoring process. Requirements for the realization of Goal Based Scenarios are fulfilled by a number of implemented add-ons.

Introduction

E-Learning plays a significant role in the field of education and training today. In this connection, the success and acceptance of tutoring systems depends on the quality of the mediated knowledge and skills as well as the quality of how these things are mediated. By now, a considerable assortment of authoring systems exists [1], which support authors well in developing high quality tutoring material. Nevertheless authors still ask for special help for a suitable instructional design of their work. This applies particularly in the field of problem-oriented learning. We designed and implemented an authoring tool to fill this important gap.

The theoretical basis of our system is the instructional design theory of Goal Based Scenarios developed by Roger Schank [4]. Referring to this approach, the authoring tool guides case engineers in designing cases to teach procedural knowledge to solve problems on a high level. In a first step the case engineer identifies the target skills and defines concrete learning objectives, which are realized by defining an exact mission and its submissions. The mission is embedded in a realistic, authentic and enriched cover story that supports the learner to associate him with the real case situation. Finally, two main focuses of the cognitive learning process are supported, namely the discovering of information and the explanation of theoretical and procedural knowledge. Concretely, tasks and learning materials are realized by various learning operations. For example, in the medical domain of Docs ‘n Drugs [2], those operations include searching information according to diagnostic reasoning, answering questions for relevant examinations and choosing alternatives to find the correct diagnosis.

Usually, a tutoring case can be used for different target groups with special learner profiles. Nevertheless, it has to be adapted to the special requirements of each group. Thus we designed our authoring tool to support structuring a tutoring case for allowing the selection of specific case-scenarios and difficulty levels.



Basic authoring features

The basis of a tool for authoring instructionally designed tutoring systems is a set of basic features that allow building appropriate special support modules upon them. We implement a hierarchical system of modules and frames. Frames form the leaves of the hierarchy and contain presentation and interaction elements shown to the learner. See Figure 1 for an example. Contents can be fed into single frame slots on a declarative level, while the author separately specifies the presentation and interaction elements that display these contents. Concrete

tutoring system implementations are generated based on these specifications, including web based systems and standalone applications. By this procedure, contents become resistant to individual demands and future technological developments of tutoring systems. The nodes of the hierarchy are modules, consisting of frames or other modules that pertain to each other in content. For each module, common properties of its elements can be defined in attribute editors. In order to specify which other frames or modules are reachable from a given frame or module, the author is able to draw arrows between them. These arrows can be enriched by attribute based conditions, specifying when the associated navigation possibility becomes active. For example, in Docs 'n Drugs the module for a first acquisition of patient data is typically connected to a module where the medical student has to decide which technical examinations have to be done necessarily. The student is not able to reach the second module until he has performed a specified set of anamnesis and body examinations. In a similar manner, an author can create conditional branches within a navigation possibility. For that he draws arrows from a condition node to the possible alternatives for the navigation. A special condition editor feeds the conditions into the system.

Instructional design components

Before an author builds concrete frames of a tutoring case, the learning objectives of that case must be identified. We offer possibilities to formulate learning objectives and assign them to the tutoring case, to modules, or finally to individual frames. Based on the assignments made, the system can build a learning objectives map that helps the author to get an overall view of the didactical structure of his tutoring case.

Learning objectives are realized by a framework of missions and submissions that a learner has to perform. For that, our system allows the definition of instructional design patterns, which form the basis of such frameworks. Instructional design patterns are implemented by configurations of named modules and basic navigation structures, where each module can be supplemented with frames that realize common case aspects. For example, an instructional design pattern that is typical for Docs 'n Drugs includes a module for the standard acquisition of patient data plus frames for a first differential diagnosis, a module for performing specific examinations and making the final diagnosis, and a module for finding the appropriate therapy. Those patterns can be stored, integrated into the user interface of the authoring system, and reused for the design of other tutoring cases.

We support the realization of two important focuses of the cognitive learning process: the discovering of information and the explanation of theoretical and procedural knowledge. For that, frames can be associated with facts like for example patient data. Furthermore, a general rule editor allows relating facts with each other or with procedural knowledge. Thus, patient data can be related to diagnoses, while diagnoses together with patient circumstances can be related to appropriate therapies. Based on that, tutoring systems can realize facilities to discover and explain the formulated facts and relations. For example, Docs 'n Drugs does this by displaying found relevant patient data in a finding map and asking for the relations in special differential diagnosis and therapy tools.

In order to prepare tutoring cases for the use by different target groups, it has to be kept modular and variable adequately. The use of modules within instructional design patterns and their association with general learning objectives enables a specific selection of those modules by the tutoring system for a given target learner group. Additionally, our system allows formulating different variants of a single frame, frame element, or conditional branch, each of which can be associated with facts like user levels or learning objectives. Those associations together with user preferences or user modeling components allow an individualized configuration of the tutoring case.

Conclusion

The system is implemented in Java and supports jar plugins to extend and adapt its functionality to author needs. An application generator allows different environment realizations like client-server, CD, or web-based products. An XML interface allows the exchange of tutoring data between applications. As far as medical tutoring cases are concerned, we are also involved in standardization efforts [3] for that kind of material.

Ongoing work will focus on the further development of a library of relevant instructional design patterns. This will happen together in corporation with our internal and external application partners.

References

[1] Dean, C. (Ed.): Technology Based Training & Online Learning - An overview of Authoring Systems and Learning Management Systems available in the UK. Sheffield, UK. Department for Education and Skills, Dean Interactive Learning Ltd, Snaithing Grange Annexe, Snaithing Lane, Ranmoor, Sheffield S10 3LF: 2001. URL http://www.deancbt.demon.co.uk/authrep/authrep.pdf. - Updated: June 2001.

[2] Docs 'n Drugs – The Virtual Policlinic. http://www.docs-n-drugs.de.

[3] MedicML. http://www.medicml.de.

[4] Schank, R. (Ed.): Inside Multi-Media Case-Based Reasoning. Mahwah, NJ: Erlbaum Ass, 1998.