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Combined Interactive Presentation of Patient Cases and Linear Contents: An Application in Oral and Maxillofacial Surgery.

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Abstract

Many case-based learning systems are characterized by both time-consuming authoring processes as well as a rigid scheme of interaction with the provided cases. In this paper, an XML-driven e-learning framework is presented which can be generically applied in various medical disciplines. It focuses on the effective development and multimedia-based presentation of patient cases, linear contents and questions. Contents related to each other can be linked and displayed together.

In the Division of Oral and Maxillofacial Surgery at the University Hospital Freiburg this framework was introduced and evaluated through an e-learning system providing a presentation of 41 authentic cases in combination with two standard textbooks. An evaluation showed that learning with the e-learning application resulted in similar learning outcomes than conventional paper based method.

Keywords:

e-learning; oral surgery; maxillofacial surgery; case-based learning; multimedia; XML presentation framework

Introduction

In electronic medical education the interactive multimedia-based presentation of authentic patient cases in combination with systematic background information has shown to be of great value for the acquisition of clinical knowledge. Many sophisticated case-based learning systems with complex user interfaces are available which focus on a problem-oriented learning paradigm [1-4]. They usually require high levels of authoring resources and are sometimes rigid and time intensive in the presentation of material to the learners [5]. Also, learners in today's crowded medical curricula require time-effective methods to learn on authentic case-based materials without the need to follow a certain didactic concept. Furthemore, it is important to support the learners in acquiring, refreshing and combining their systematic knowledge. This is further supported via directly connecting this knowledge to specific cases without the need for any complex search.

In the following, a platform is presented that focuses on both the easy and effective authoring as well as presentation of patient cases and linear contents by employing standard XML tools. The contents can be combined through linking and presenting them together to provide the learner with a unified view on the medical subject of interest.

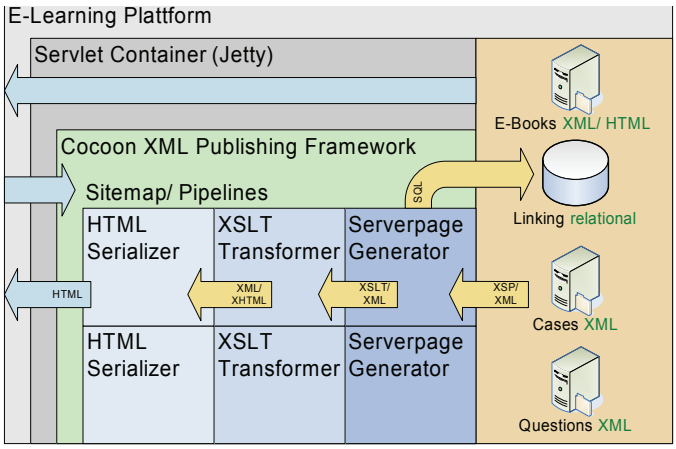

Figure 1 – Generic architecture of the e-learning platform based on the Apache Cocoon XML publishing framework. Cocoons concept of highly modularized "pipelines"enables the rapid development of extensible and reusable software

Methods

A schema driven e-learning platform for the effective presentation of cases and sequential systematic knowledge has been developed, technically based on the Apache Cocoon framework (Figure 1). It can give access to large quantities of cases and linear content with simple hierarchical navigation and search. The sustainable usage of the platform in various medical disciplines is guaranteed by application of extensible schemas and standards.

The case structure is geared towards clinical practice and expressed in a generic RelaxNG XML schema extendible according to specific clinical implementations. The effective authoring and learning has been given special

emphasis by reducing the complexity of the cases to a level that allows for easy access to the cases but is still detailed enough to clarify specific clinical processes.

Linear contents are expressed in the well established DocBook XML standard [6]. Transformation of the DocBook-conformant contents is performed with open-source tools permitting a high flexibility in output design and format. The linkage of patient cases, corresponding background knowledge and associated questions is implemented with common relational database techniques.

Figure 2 – Graphical user interface (in German).On the top-left the main menu appears above a full text search dialogue box. The patient case navigation is shown as a hierarchical tree structure enabling the learners to quickly access the parts of interest. Below the case header a listof links to the relevant systematic contents is opened fordirect access to the associated e-book.

Results and discussion

In the Division of Oral and Maxillofacial Surgery at the University Hospital Freiburg an e-learning system has been developed and evaluated based on the introduced platform providing 41 multimedia-enhanced authentic patient cases and two extensive standard textbooks covering oral and maxillofacial surgery [7, 8]. Navigation between the cases and their corresponding background knowledge has been made possible via two-sided links that are easy to follow from either the case or the e-book.

A controlled cross-over evaluation in the winter semester 2006/07 (n=42) showed e-learning and conventional (paper based) learning to have similar learning outcomes (9.4 vs. 9.5 from a total of 20 point). The assessment of the direct benefits in medical education associated with the particular learning methods is significantly different between e-learning and conventional learning: 4.2 vs. 3.6 on a 5 point Lickert scale (p=0.005). The “fun-factor” while working on the cases differed also significantly: 4.1 vs. 3.2 on a 5 point Lickert scale (p=0.005). In principal, the usability of the e-learning application was evaluated as being good.

The evaluation results further suggest that learners are satisfied with a comparably simple e-learning system which gives them direct access to patient cases and linear contents without the need for any complex interaction. It is highly important for the sustained success of such an e-learning application with only loose user guidance to be integrated in the curriculum in a blended learning approach: medical teachers use e-learning side-by-side with other more conventional means to enrich their lectures.

Further development is directed towards enhanced presentation and navigation of cases and linear contents as well as the extension of the current system to other medical subjects (e.g. general surgery).

An extensible and flexible medical e-learning platform based on XML technologies has been presented enabling the development and presentation of case-based and linear contents. The platform was successfully introduced and evaluated in the field of oral and maxillofacial surgery and is now subject to further extension to general surgery.

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