

# Interoperability of case-based training systems in medicine: The CASEPORT approach

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## Introduction and Aims

Case-based learning has established itself as an essential part of medical education. The logistic limitations in the timely provision of learning with real patients to students with special regard to patient availability can partially be overcome through the use of virtual patients. Accreditation requirements ask US medical schools to document all patient encounters of their students with virtual patients as an appropriate substitute for real ones [1]. Although several computer-based systems for learning with virtual patients were developed over the years, the lack of a common case repository limited the integration of virtual patients into medical curricula as an educational enrichment.

In CASEPORT thirteen German Medical Schools cooperate to build a common internet platform and to complete existing case collections to provide a broader coverage of important subjects in medical education. The CASEPORT project [2,3,4] (<http://www.caseport.de>) aims at bundling existing resources and augmenting the inventory of available high-quality interactive cases to improve medical education. CASEPORT is, by design, open for the modular integration of further learning systems. A comprehensive content quality assurance and evaluation process is part of the CASEPORT workflow, which facilitates the integration of virtual patients into medical curricula.

CASEPORT makes available extensive collections of medical cases from various distributed first rank case-based e-learning systems to teachers, students and physicians in Germany. By unifying content from various sources, a critical mass for the integration of online case-based courses into undergraduate and postgraduate medical contexts is provided.

Currently five learning systems provide content to the CASEPORT portal:

- CAMPUS (University of Heidelberg/Heilbronn) [5]
- CASUS (University of Munich) [6]
- d3web.Train (University of Würzburg) [7]
- Docs 'n Drugs (University of Ulm) [8]
- Prometheus (University of Tübingen)

All CASEPORT subsystems provide authoring components and web-based players, using either Java applets or JavaScript-supported HTML, and run in common web browsers. Each system enables medical experts to create cases with a specific didactical structure and gives appropriate support in case creation - unlike standard

authoring-tools like Macromedia Director. Thus, teaching content can be quickly created and modified as the state-of-the-art diagnosis and treatment for a disease changes.

## **Methods**

To facilitate the cooperation between the different CASEPORT subsystems a technical integration concept for unified user-management, tracking of learners' performance and learner cooperation was developed. This paper describes the resulting structure of CASEPORT-components and the information flow between them to achieve the intended interoperability. In CASEPORT well-proven learning systems are equipped with a common interface for sharing their learning content through an integrating web portal. Cases are represented with semantically interoperable metadata in an XML (Extensible Mark-up Language) format. This approach of interoperability was successfully implemented in other contexts for medical information modeling [9,10]. SOAP (Simple Object Access Protocol) was chosen to exchange data between the portal and the individual learning systems. The exchanged data includes case metadata, terminological information and user session data for single-sign-on.

An intuitive user interface allows the search for relevant learning content in the common knowledge pool of all contributing systems. The target group of CASEPORT are students, teachers and course instructors, and physicians in residency and continuing education. Courses across all involved systems can be created. Evaluation data of learners are centrally processed across all subsystems and users benefit from communication services like chat and newsgroups.

## **Results**

CASEPORT has succeeded in establishing a distributed common infrastructure and common interfaces for major medical case-based learning systems in Germany. The case-database has met both students' and teachers' demands after minor adaptations of the metadata structure. Content development was mainly focused on non-operative clinical subjects: internal medicine, pediatrics, psychiatry and neurology. Each content development consortium consisted of two or three teams from different medical faculties. Clinical experts were supported by "knowledge engineers" from the targeted learner groups that were responsible for the collection and processing of case-related materials including images and AV-clips. The role of the experts was the critical surveillance of the knowledge engineers and regular reviews of their own cases as well as of the ones developed by their colleagues within a consortium.

Curricular integration of cases depended upon the local needs of the participating faculties. Online cases, mostly integrated as courses were used in different teaching scenarios: as supplement to lectures, for the preparation of seminars, or other small group teaching settings, or for independent self-study. Evaluation data was used for feedback for the involved faculty members in a formative and summative way, as cases were also used for online-examinations in controlled settings.

## **Discussion**

The system interoperability concept of CASEPORT is a novel approach for the seamless sharing of online teaching materials. A fifth learning system was successfully integrated (Prometheus) with minimal effort, thus proving the functionality of the technical interface concept. In the future we expect additional case-based training systems to join CASEPORT. Since CASEPORT currently only deals with case-based content, it is intended to also integrate links to systematic and didactical content materials like textbooks, literature databases, and other online teaching materials. The acceptance of CASEPORT by students and teachers has yet to be shown and is currently evaluated. An English version of CASEPORT is under development for the integration of further content materials, learning systems, and user communities.

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### **Literature**

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