The UMassMed Question Database: A Web-based Educational Resource

S. L. Wertheim, PhD, R. M. Plovnick, B. E. Terry, C. A. Cardasis, PhD, R. A. Baldor, MD and L. Riza, MS, Office of Medical Education, Department of Cell Biology and Department of Family Medicine, UMass Medical School, Worcester, Mass.

Introduction
One common need in education is to present questions, judge the response and give appropriate feedback. In medical education, the background information for a question often includes extensive text (such as a case description) or image material. Where images are involved, it is often desirable to allow the student to answer a question by direct interaction with the image. We have developed the UMassMed Question Database, a resource that can be used by several courses and expanded over time.

Methods
The software was created with the Butler SQL relational database, the Tango Web/database application development environment (Pervasive Technology) and the WebStar Web server (StarNine). Web pages were created with Macromedia Dreamweaver. 35mm slides were scanned using a Polaroid LS 3500 slide scanner. Digital images were edited with Adobe PhotoShop. Interactive labels were added to images using Macromedia Fireworks. The software architecture separates program logic, graphical development and presentation, and text creation and editing.

Results
The UMassMed Question Database is a uniform mechanism for the creation and delivery of interactive study questions in a wide variety of subject areas. It can handle a variety of question types: identification, multiple choice, and short answer. Depending on the question type, faculty can store one or more correct answers and one or more anticipated incorrect answers. Presentation of questions and navigational features are database driven. For example, the action of Previous and Next buttons, question order and count displays (e.g. "This is question 3 of 11") adapt themselves to the contents of the database and do not require maintenance. Questions are presented via Web pages and then judged against stored correct and incorrect answers. Feedback is immediate, but student answers can be stored for later faculty review.

Although the fundamental data are stored in a standard way, many user-interfaces are possible. We have demonstrated this by creating two very different applications: review slides for a first-year Histology course and a set of Family Practice Otolaryngology (ENT) clinical cases for physicians in residency training.

Questions are created and edited using Web-based forms, which are password protected. Each question has an introductory or background portion that can be a plain text file or any HTML page. Thus it can include an image, animation or segment of digital video. Faculty can review the list of questions in a course or unit, test a particular question and edit its text-based components, all without programming or writing HTML.

Judging the correct answer for identification and multiple-choice questions is straightforward. However, judging short-answer questions is more difficult. We decided to restrict our short answers to phrases of a few words, avoiding the rigors of natural language processing. Each question can have one or more correct answers and as many incorrect answers as the faculty member can anticipate. Each correct or incorrect answer can have its own explanatory text (feedback). When the student sends an answer to the server, it is compared to the stored correct and incorrect answers. We respond to partially correct answers with a standard set of phrases depending on the closeness of the match.

Discussion
One of our goals was to make question creation accessible to faculty without extensive Web or programming skills. However, some of the interactive graphics techniques we use require thorough knowledge of programs like Adobe PhotoShop and Macromedia Fireworks. We feel we have achieved a compromise where the text portions of the question are editable by faculty without any special computer skills. Moreover, the faculty member can reorder questions and turn particular questions on or off, at any time.

In the future we plan to store all incorrect answers for faculty review so that our feedback and our list of anticipated answers can be improved. A current limitation of the Question Database is that only one form of a correct answer is allowed. This will be addressed by modifying the judging routine to accept a synonym list for correct answers.