Medical informatics in the curriculum: development and delivery of an online elective

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INTRODUCTION

Edward Shortliffe's often-cited definition describes medical informatics (MI) as:

> The rapidly developing scientific field that deals with the storage, retrieval, and optimal use of biomedical information, data, and knowledge for problem solving and decision making. It accordingly touches on all basic and applied fields in biomedical science and is closely tied to modern information technologies, notably in the areas of computing and communications. [1]

This definition provided the context for a survey of medical informatics course, a two-week online elective for medical students. Technology provided the means to deliver course content as instructors took full advantage of evolving courseware, multimedia production tools, and web applications.

BACKGROUND

The University of Illinois at Chicago (UIC) Library of the Health Sciences-Peoria (LHS-P) is one of four regional sites of the UIC Library of the Health Sciences and supports the UIC College of Medicine (COM), the UIC Regional College of Nursing, and the Peoria community at large. Each year, approximately 50 of 150 medical students who have completed year one on the Urbana campus transition to the COM-Peoria, where they complete years two, three, and four.

In 2005, the COM-Peoria's Committee on Instruction and Appraisal (CIA) charged a subcommittee with developing a plan to formally integrate medical informatics instruction across the curriculum. At the time, librarians provided instructional sessions in the second-year pharmacology and public health and epidemiology courses, as well as an introduction to evidence-based medicine in the third-year internal medicine clerkship. These sessions provided experience using a variety of information resources and search techniques, and they exposed students to basic and advanced features of PubMed. The committee, which was chaired by the librarian representative to the CIA, identified other points in the curriculum where informatics could be logically and logistically included. As a result, librarians collaborated with medical faculty during the second-year introduction to clinical medicine course to lead small group learning in the use of evidence-based resources to answer case-based questions. The subcommittee also recommended developing a medical informatics elective that would enhance existing informatics instruction and better prepare students for residency, clinical practice, and lifelong learning.

DEVELOPMENT

A search for other models of medical informatics instruction revealed that the elective format was not without precedent: Texas A&M first offered ''Computers and Medical Information'' as a fourth-year elective in 1992. Their course relied on library and medical faculty collaboration to enhance student exposure to computerized biomedical information management [2]. Similar to the pre-2007 informatics program at the COM-Peoria, Espino and Levine's 1998 survey of MI curricula revealed that ''most [schools] have aspects of medical informatics incorporated into current courses and utilize existing faculty'' [3]. Buckeridge and Goel found general theoretical support for medical informatics; however, they noted a poor understanding of the scope of the discipline, problems identifying qualified faculty, and scarce curriculum hours as significant barriers [4]. Aiyer et al. also examined the status of MI training in medical education in 2009 and reported that slightly more than half of respondents identified some formal strategies for MI training in their respective curricula, citing cost and demands on faculty time as major barriers [5].

LHS-P faculty envisioned the elective as an overview of MI that would focus on basic principles, concepts, technology, and terminology. An inventory of informatics topics and research skills already in place across the curriculum served as the foundation for new or supplemental content for the elective. The five future roles for medical students (clinician, researcher, manager, educator-communicator, and lifelong learner) identified in the Medical School Objectives Project provided the initial organizational framework [6].

The overall objectives for the course were that upon completion of this elective, the student will be able to:

1. understand what medical informatics encompasses and how it relates to various roles in the practice of medicine, including clinical care, research, teaching, and lifelong learning
2. retrieve, evaluate, and apply medical information as it pertains to each of the major four roles addressed in the course
3. consider the basics of electronic medical records, patient management systems, decision support tools, patient safety, and patient education as they apply to clinical care and practice management

Supplemental Table 1 and Table 3 are available with the online version of this journal.

4. develop a personal information management plan

Blackboard was the logical choice for course management as it was widely used at UIC, librarians were already familiar with the basic functionality, and it accommodated 24/7 secure access. Although the librarians initially considered a blend of synchronous and asynchronous activities, several factors rendered this unworkable. The number of students taking the course at any given time was unpredictable, and student travel further complicated scheduled synchronous activity. The asynchronous format also afforded librarians the flexibility to interact with students and grade assignments as time allowed.

Three faculty librarians assumed responsibility for individual course topics based on expertise and interest. While collaboration with medical faculty was considered, time constraints and teaching obligations could not be overcome; however, librarians consulted with practitioners for clinical cases. Six major topic areas—medical informatics, clinician's perspective, health literacy, the research process, teaching and learning, and lifelong learning—with relevant subtopics, typically included a recorded lecture, required and/or recommended readings, and self-guided activities and/or an assignment (Table 1, online only). Instructors used PowerPoint and Camtasia to record and produce lectures and demonstrations. UIC's secure electronic reserves repository housed required readings. It was expected that students would spend twenty-five to thirty hours per week on course work.

Assignments were designed to assess student assimilation of MI theory, concepts, and tools, while also creating opportunities to learn about technology. Most assignments were accommodated by Blackboard's built-in assignment component. Case-based assignments required students to solve a clinical problem as well as analyze the resources used to find the information. A few assignments required students to post commentary using the discussion board. One assignment directed students to contribute to a course wiki that served as an organic collaborative glossary of technology terms. A required blog posting yielded students' reflections on the undergraduate medical education experience. Other assignments called for database customization, really simple syndication (RSS) creation, bibliographic management, and web personalization. Assignments were graded on a one-to-five scale resulting in a cumulative course grade that corresponded to the COM's outstanding, advanced, proficient, needs remediation, incomplete, and unsatisfactory grading system.

IMPLEMENTATION

The elective was piloted by three students in January 2008. Feedback from this group resulted in changes to some assignments and readings that were found to be too time consuming for a two-week time frame. Because there was limited opportunity for face-to-face interaction, an online syllabus addressed expectations, grading, and logistics. Initially, course instructors did not limit the number of participants; however, increasing demand created an unanticipated burden that led to the implementation of a five-student limit per session, beginning in the summer of 2010.

Feedback from students continually informed the evolution of the course, which underwent substantive updates in 2009 and again in 2010. In the summer of 2009, a companion guide that provided a detailed table of each topic's components was added to the syllabus so that students could be sure they had completed all course requirements. Other changes included updates to course organization, new readings and assignments that reflected changing technology, and a new grading rubric based on more rigorous assignments. The prerequisite for the course was changed from fourth-year standing to completion of the second year.

ASSESSMENT

Initial student feedback was gathered from anecdotal comments in the discussion board area of the course site, as well as a question-and-answer formatted survey in SurveyMonkey. In the summer of 2009, the survey was moved to Blackboard; however, initial Blackboard survey results were lost due to technical error. A total of fifty-three surveys dating back to 2008 were available.

General comments about the course suggested that many students felt the information they learned would be useful for residency and future medical practice. Students reported that lectures were the most effective learning tool, while readings and assignments were least effective (Table 2). Readings were frequently characterized as dry or redundant. Students cited flexibility and self-paced learning as advantages of the asynchronous format, while they acknowledged lack of interactive discussion as a drawback. Despite these assessments, successful completion of the assignments suggests that students did in fact learn from the readings and assignments. RefWorks, current issues in medical informatics, continuing medical education, keeping current, mobile computing, and resources for clinical practice were cited as the most useful topics (Table 3, online only). The majority reported feeling greater competence and confidence in MI as a result of the course, particularly with regard to the challenges of the electronic medical record (EMR), scholarly communication, information access issues, definition of MI, and description of issues of information storage and retrieval.

In addition to exposing students to basic principles of medical informatics, the course was designed to provide learning opportunities for students in the use of newer technologies such as wikis, blogs, and threaded discussions. About one-third of surveyed students indicated that the Web 2.0 topic was useful.

Table 2
Students' rating of effectiveness of learning tools used during the course 2008–2010 (n=53)

	Excellent		Good		Fair		Poor	
	n	(%)	n	(%)	n	(%)	n	(%)
Lectures	25	(47.17%)	23	(43.40%)	5	(9.43%)	0	(—)
Readings	12	(22.64%)	23	(43.40%)	17	(32.08%)	1	(1.89%)
Assignments	16	(30.19%)	26	(49.06%)	10	(18.87%)	1	(1.89%)
Discussion	16	(30.19%)	24	(45.28%)	10	(18.87%)	2	(3.77%)
Facilitation	17	(32.08%)	24	(45.28%)	9	(16.98%)	2	(3.77%)
Communication	18	(33.96%)	24	(45.28%)	9	(16.98%)	2	(3.77%)

This may be due in part to technical problems with the wiki and blog tools that occurred when the courseware was upgraded to a new version. There was no anecdotal evidence to suggest that students were already well versed in these technologies.

DISCUSSION

For students, difficulties with Blackboard functionality led to incomplete assignment submissions and problems using some tools, such as the Blackboard wiki. It was not uncommon for students to struggle to complete all course requirements in the two-week period, and extensions were granted in reasonable circumstances.

For instructors, development of the course in the online environment presented multiple learning curves. Major challenges included recording and producing lectures for optimum accessibility and mastering Blackboard assignment and grade book tools. Technologies used to create and manage the course changed in the summer of 2009, when a new and quite different version of Blackboard was implemented. Although the course is asynchronous, demands on the instructors to provide timely feedback have been challenging, particularly during instances of maximum enrollment. Sustainability remains an important consideration as course content must be regularly reviewed to reflect the changing landscape of MI.

CONCLUSION

Since 2008, more than 100 students representing all 4 of the COM campuses have completed the elective, and the majority have rated the course as excellent overall. In general, students seem satisfied and even enthusiastic about the elective as borne out by feedback indicating a high level of satisfaction. Anecdotally, many students were pleasantly surprised by the course content, which sparked new areas of interest in topics such as health literacy and scholarly communication. The online format has proved to be effective in filling a void in the curriculum and providing an opportunity for self-paced learning for a significant number of students.

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