

## INSTRUCTIONAL DESIGN AND ASSESSMENT

### An Interdisciplinary Online Course in Health Care Informatics

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**Objectives.** To design an interdisciplinary course in health care informatics that enables students to: (1) understand how to incorporate technology into the provision of safe, effective and evidence-based health care; (2) make decisions about the value and ethical application of specific technologies; and (3) appreciate the perspectives and roles of patients and providers when using technology in care.

**Design.** An online, interdisciplinary elective course using a distributive learning model was created. Standard courseware was used to manage teaching and to facilitate student/instructor interactions. Interactive, multimedia lectures were developed using Internet communication software.

**Assessment.** Upon completion of the course, students demonstrated competency in identifying, analyzing, and applying informatics appropriately in diverse health settings.

**Conclusion.** Online education using multimedia software technology is effective in teaching students about health informatics and providing an innovative opportunity for interdisciplinary learning. In light of the growing need for efficient health care informatics training, additional study of this methodology is warranted.

**Keywords:** Informatics, online instruction, interdisciplinary education, internet

## INTRODUCTION

Rapid advancement in computer technology and the increasing availability of electronic health information are revolutionizing health care systems worldwide. Innovations in technology have made portable electronic devices, network database applications, electronic medical records, and computer software programs increasingly integrated into many health care settings. These changes create the educational need for health care providers to become proficient at appropriately using technology to deliver high quality health care services. This need is highlighted in an Institute of Medicine (IOM) report which recommends all programs that educate and train health professionals should adopt 5 core competencies; specifically, the abilities to (1) deliver patient-centered care, (2) work as a member of an interdisciplinary team, (3) engage

in evidence-based practice, (4) apply quality improvement approaches, and (5) use information technology.<sup>1</sup> Interestingly, these competencies can all be connected to the emerging area of medical (or health care) informatics, which is defined as the scientific field that deals with biomedical information, data, and knowledge, and their storage, retrieval, and optimal use for problem-solving and decision-making.<sup>2</sup>

Despite growing research in this area, however, relatively few pharmacy schools offer dedicated training programs in informatics and or the opportunity for interdisciplinary learning in the area. Indeed, a recent comprehensive review of pharmacy informatics education in professional programs at US colleges of pharmacy suggests that only a third of pharmacy programs offer any courses in pharmacy informatics and even fewer (16%) require this coursework.<sup>3</sup> Through a similar review process conducted within their institution, the authors identified a need for informatics training in several of the health professions programs, suggesting that an interdisciplinary course would not only be consistent with the IOM recommendations, but also be an efficient method of introducing these concepts. To accommodate the difference in academic schedules among students in the different health programs as well as to illustrate the concept of “using technology to teach about technology,” it was determined that an online course would be the most

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appropriate format. This manuscript describes the development, implementation and evaluation of *Health Care Informatics*, an interdisciplinary, online course at the University of North Carolina (UNC) at Chapel Hill.

## DESIGN

The University of North Carolina at Chapel Hill health sciences group consists of the Schools of Pharmacy, Medicine, Nursing, Public Health, and Allied Health, and the Health Sciences Library. As the authors (both pharmacists who have completed national training programs in health informatics) collected information about the availability of informatics instruction on their campus, they identified some discipline-specific informatics topics within the curricula of several programs. Through networking, an advisory council of interested faculty and staff members from these constituent schools and programs was recruited to serve as reviewers and lecturers in the new interdisciplinary course. In addition to the course development objectives, the council met quarterly to discuss contemporary informatics topics as well as to explore mechanisms for funding new program initiatives.

Creating new courses is a resource-intensive process and using new (eg, technology-enhanced) methods and recruiting from multiple audiences (eg, a variety of professional programs) can lead to challenges in the development process. Because of the interdisciplinary recruitment and online course format, the *Health Care Informatics* course qualified for development funding from the UNC Health Affairs Interdisciplinary Education Committee. In addition, course implementation was funded by an educational grant received from a private philanthropic organization. This funding provided support for dedicated computer hardware, digital camera, microphone, software purchases/site licenses, modest honoraria for external lecturers, and salary for a graduate student assistant.

Specific course content was identified through a variety of mechanisms. Practicing pharmacists (N = 51) attending a statewide workshop on pharmacy technology were surveyed about their current informatics priorities. This information was combined with data collected through literature review and attendance at scientific meetings, then reviewed by members of the advisory council for further prioritization. Because of the variability of the interdisciplinary target audience, it was decided that the course would provide an overview of the field with an opportunity to develop depth in a particular area of interest via the required project assignment. The final weekly topic list is shown in Table 1.

Table 1. Topics Covered in an Interdisciplinary, Online Course in *Health Care Informatics*

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|   |
|---|
| 1. Introduction to <i>Health Care Informatics</i>         |
| 2. Information Management and Evaluation                  |
| 3. Electronic Health Records and Computerized Order Entry |
| 4. Health Care Terminologies and Coding                   |
| 5. Clinical Decision Support Systems and Patient Safety   |
| 6. Mobile Computing and Handhelds in Health Care          |
| 7. Public Health Informatics                              |
| 8. Patient Care Management and Monitoring                 |
| 9. Consumer Health  |
| 10. Security, Privacy and Ethics                          |
| 11. Telehealth  |

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Curricula in health science programs are generally governed by individual schools, and because of this, the University's mechanism for course approval for an interdisciplinary offering was not easily navigated. Essentially, the proposed course first needed approval by the School of Pharmacy Curriculum Committee using the school-specific process. Following this approval, the curriculum committee of at least one other health sciences school needed to approve the course in order for it to receive an interdisciplinary designation. Once approval at a second school was granted, the University reassigns the course an interdisciplinary number that could be publicized for enrollment purposes. Ultimately, the authors received approval from the School of Pharmacy and then requested approval in the School of Public Health because of a longstanding collaborative relationship with the graduate program there. With the interdisciplinary number and course title, enrollment was positioned as a 2-credit hour elective course for third-professional year pharmacy students and students from other health programs who had completed similar prerequisites.

The course coordinators created a web site to describe the course and to provide a preview of the courseware and delivery system. To request permission for enrollment, interested students were required to submit some demographic information (eg, discipline, previous computer experience) and to complete a validated assessment of their readiness to participate in online learning.<sup>4</sup> After students were screened and registered for the course, one face-to-face meeting on campus was scheduled to orient the students to the course coordinators, the course format, and the software.

*Health Care Informatics* was the first online offering of the UNC School of Pharmacy, so technical support and resources were limited. Unlike some courses described in the literature for which content tested in the classroom was transformed for online application,<sup>5</sup> *Health Care*

*Informatics* was developed as an online course from the onset. With this in mind, the authors spent considerable time reviewing the literature about effective learning in the online environment.<sup>6-10</sup> This literature suggests that successful technology-based learners are confident, motivated, persistent, and able to assume responsibility for their own learning. These students are also typically busy people who manage their time well. The course format was developed with this target audience in mind.

To deliver the course, the authors reviewed the many standalone software packages available but ultimately selected technology that was compatible with Blackboard, the University's existing course management software because that system was supported around-the-clock and was familiar to students who would enroll in the course. Lesson "lectures" were deployed via Blackboard using Macromedia Breeze software (now Adobe Connect Professional). This software allowed the individual lecturers to create their media using a standardized Microsoft PowerPoint template designed by the authors to optimize online visibility. Next, lecturers recorded voice narration for the slides. These files were combined and converted to Macromedia Flash format by the Breeze software to minimize file size and maximize accessibility. To optimize the attention span of the learner, online lectures were divided into thematic segments no longer than 20 minutes in length with some type of feedback exercise prior to accessing the next segment.

After the live orientation meeting, the remainder of the course was delivered online in a quasi-synchronous format; with new lessons posted each Wednesday by 8:00 AM EST and students completing weekly activities subsequently by the following Tuesday at 11:00 PM EST. All lessons utilized a uniform user interface with standard links to instructor information, objectives, readings, the *Breeze* lectures, an interactive exercise (eg, a discussion board), summary points, supporting links, a 5- to 10-item online quiz to self-evaluate learning, and a brief, anonymous online survey to provide feedback on the lesson.

## ASSESSMENT

The demographics of the students who completed the course are presented in Table 2. To introduce themselves virtually to the instructors and cohort, students created *Blackboard*-based personal web pages describing their health care interests. After establishing this baseline, they regularly provided comments on their classmates' work using the discussion board function of the course web site. Both the quantity and quality of student postings increased as the course progressed, suggesting that students' comfort with using the media and software improved over time. Frequently, the online discussions

Table 2. Demographics of Student Enrolled in an Interdisciplinary Online Course in Health Care Informatics, N = 13

|   | No. (%)  |
|---|----------|
| School of Pharmacy  | 6 (46)   |
| School of Public Health   | 3 (23)   |
| School of Information & Library Science   | 2 (15)   |
| School of Nursing   | 2 (15)   |
| Students (from any discipline) taking the course for credit at the graduate level                           | 4 (31)   |
| Score on readiness for online learning assessment <15*  | 13 (100) |
| Students not enrolled in a campus-based degree program <sup>†</sup>   | 2 (15)   |
| Had enrolled in an <i>online</i> course in past   | 8 (62)   |
| Had enrolled in an <i>interdisciplinary</i> course in past  | 3 (23)   |
| Originally enrolled in this course <i>primarily</i> because of:   |          |
| flexibility in schedule   | 8 (62)   |
| interest in the topic   | 5 (38)   |
| At the beginning of the semester, felt they knew <i>less</i> about the course content than their colleagues | 6 (46)   |

\*scale = 10-30, with 10 being the ideal score for online instruction

<sup>†</sup>for example, commuter students from out of state or out of country

highlighted that different professions have different views on the incorporation of technology into health care. Students even requested their own "open" discussion board for informing one another about information technology resources they identified from other extracurricular sources. Weekly reviews of the modular lesson were positive and participation in course activities was high. At the end of the course, more than half the students (54%) indicated they felt more comfortable participating in online course discussions than classroom-based (live) discussions. Several students (38%) joined the American Medical Informatics Association (AMIA) as a result of learning about the organization in the course, suggesting a continued interest in learning about health care technologies.

Overall performance in the course was very good and students consistently met or exceeded the course expectations (mean final score = 92%, range 78%-98%). In addition to the self-assessment quizzes and the weekly activities, each student completed an informatics project of their choosing and presented this using voice-annotated PowerPoint slides accessible via the Blackboard page. Projects were peer reviewed by 1 student from his/her discipline and 1 from outside his/her discipline, prior to the instructor's evaluation. Students reported that the process of having their project reviewed by a student enrolled in another discipline, as well as having to review the

project of a student enrolled in another discipline was meaningful and interesting. Table 3 lists these projects.

A majority of students (54%) indicated that the concepts covered in the course had not been covered elsewhere in their required curricula (ie, the topics were not duplicative); although nursing students were more likely to report some exposure to these areas as compared to students from other disciplines. Several students (46%) commented that they appreciated that online faculty lecturers represented a variety of disciplines, reflecting both the interdisciplinary nature of the course and the field of informatics. At the end of the course a comprehensive online survey in which all students provided anonymous feedback showed that 100% of the students would recommend the course to other students, thought the course would be useful in their profession, and felt it encouraged them to take responsibility for their own learning. These opinions were validated by a substantial increase in enrollment requests for the following year.

Because a substantial amount of time was spent creating multimedia lectures that could be both listened to and read, we were interested in whether students consistently used both the audio and visual components of the lessons. More than half (54%) of the students said that in most cases they did not listen to the lectures but relied instead upon the handouts and the accompanying scripts. In addition, although identity was not authenticated before completing the online quizzes, students reported that because credit was given for completion (rather than for providing the correct answers), the temptation to “cheat” on the quizzes was low. By utilizing the course statistics function of *Blackboard*, the authors were able to track the times and dates that students accessed the web site. Consistent with reports from other online pharmacy

courses,<sup>11,12</sup> students frequently accessed the site at times outside those reserved for traditional classroom instruction.

## DISCUSSION

The availability of new computer applications and information resources holds the potential to change the role of health professionals and positively influence the patient-provider relationship. Consumers and third-party payers are increasingly demanding services that require health professionals to rapidly retrieve, critically evaluate, and quickly implement new knowledge, as well as continue to provide traditional health care services. Pharmacists, physicians, nurses and other health professionals are not being adequately prepared to incorporate health information technology into practice to provide the highest quality and safest medical care possible. Providing interdisciplinary instruction in health informatics prepares health care providers with skills to utilize new technologies to prevent medication errors and improve health outcomes.<sup>13</sup>

Developing new courses, specifically those that are technology-enhanced and targeted for interdisciplinary audiences can be expensive. This course was supported via grants and similar funding that may not be available at all colleges and schools. For instructors at colleges and schools where online coursework is already prevalent, many of the supplies (eg, hardware and software) would likely be available. Partnerships between health sciences programs, however, can increase the likelihood for funding, share the expense burden, and optimize the use of faculty time. The formation of the Interschool Advisory Council was a tremendous advantage in the course development process and was consistent with published recommendations<sup>3</sup> for identifying curricular content in informatics.

Table 3. Project Topics Presented by Students Enrolled in an Interdisciplinary Online Course in *Health Care Informatics*

| Course Project Topic   | Discipline of Student Author  |
|--|-------------------------------|
| Medication Errors & Patient Safety: The Role of Computerized Physician Order Entry | Pharmacy                      |
| Technology to Address the Complications of Diabetes                                | Pharmacy                      |
| Personal Digital Assistants Solving Medical Mistakes                               | Pharmacy                      |
| Warfarin Therapy & Technology: Improving Patient Care                              | Pharmacy                      |
| Retail Pharmacy Automation   | Pharmacy                      |
| The OsteoXplorer Program   | Pharmacy                      |
| Information Literacy & Evidence-Based Practice                                     | Information & Library Science |
| Radio Frequency Identification (RFID) Applications in Health Care                  | Information & Library Science |
| Using Technology to Improve Patient Adherence                                      | Information & Library Science |
| Computerized Physician Order Entry: Implications for Nursing                       | Nursing                       |
| Barcoding in Nursing   | Nursing                       |
| Virtual Peer Educators   | Public Health                 |
| The Integration of Handheld Computers into a Sexually Transmitted Diseases Clinic  | Public Health                 |

Although the IOM report suggests that interdisciplinary instruction should be prioritized,<sup>1</sup> university and college and school policies may lag in their support of these recommendations. Such policies must be updated to decrease the barriers associated with colleges and schools pursuing innovative and nontraditional learning methods. For example, Lust<sup>12</sup> presents a model for developing an online course in veterinary pharmacy, suggesting that for some curricular content, expert centers could serve pharmacy education needs regardless of geography. This model may also be applicable in a field like informatics, where the appropriate use of technology is both a method and an outcome. In addition, as suggested in the literature,<sup>11,12</sup> once the content is available in an online format, it may be convenient for delivery to other audiences (eg, as continuing education programs for practitioners).

Elective courses such as *Health Care Informatics* can also offer the opportunity to test content and format that may be appropriate for larger groups (and/or required courses). For example, after successful use in this course, the Breeze software was adopted by the School of Pharmacy for use in its required curriculum for the new distance education program. The lessons learned using the software in the elective course led to valuable experience and insights for implementing it in courses for a larger, distance-based community.

One of the contributing reasons for the success of this course was that enrollment was limited to a small group of motivated students who had demonstrated their readiness for learning in the online environment. Because of this, it is not known how successful similar methods would be in a required course offered to all professional students. Similarly, although the creators of this course were already high-end users of technology, the individual lecturers varied in their degree of savvy with the courseware. Because of this, the *a priori* creation of templates and clear guidelines for the lesson lectures was critical. Still, a variety of methods were employed (eg, recording of lectures to live audiences, conversion of preexisting slides to the course template) to ensure that lecturers felt comfortable producing their materials. With this in mind, advanced preparation is probably more important for interdisciplinary online courses than for live courses to more narrowly defined audiences.

## CONCLUSIONS

Despite the tremendous amount of work required for creating and managing an interdisciplinary online course, the learning outcomes for the course were achieved, student feedback was outstanding, and the instructors built positive relationships with faculty members in other health sciences programs across the campus. As technol-

ogy becomes more integrated into health care, health training curricula (content and methods) should reflect this and shared expertise in the classroom (live and online) may encourage interdisciplinary team-building in practice. For the immediate future, forums such as AMIA's web-based seminar, which looks specifically at applied informatics curricula in the health professions, may be a good mechanism for opening this dialog.<sup>13</sup>

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