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INSTRUCTIONAL DESIGN AND ASSESSMENT

An Online Health Informatics Elective Course for Doctor of Pharmacy Students

Kevin T. Fuji, PharmD, MA, Kimberly A. Galt, PharmD, PhD

Creighton University School of Pharmacy and Health Professions, Omaha, Nebraska

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Objective. To describe the development and assessment of an online elective health informatics course and determine its potential for universal integration into doctor of pharmacy (PharmD) curricula.

Design. A 2-credit hour online elective course was developed and offered to all PharmD students; voiced-over Powerpoint lectures were used to deliver content.

Assessment. Assessment of student performance was measured using quantitative metrics via discussion questions, quizzes, written papers, and examinations. Qualitative findings were measured through discussion questions, a goal-setting classroom assessment technique, and an end-of-course reflection. Students report finding value in the course and recognizing how the knowledge gained could impact their future practice as pharmacists.

Conclusion. An online course in health informatics can be an effective way to deliver content and provide a blueprint for continued integration of the content into curricula.

Keywords: health informatics, pharmacy informatics, online education, health information technology

INTRODUCTION

The use of technology in health care has steadily increased since the Institute of Medicine report "Crossing the Quality Chasm" identified technology use as a key strategy for improving patient safety and quality of care across care settings.[1] In 2009, adoption of technology was further stimulated by passage of the Health Information Technology for Economic and Clinical Health (HITECH) Act, a part of the larger American Recovery and Reinvestment Act. The HITECH Act provided financial incentives designed to promote use of health information technology (HIT) throughout the country, and established the Electronic Health Record (EHR) Incentive Program, more commonly referred to as "meaningful use."[2] As the use of HIT continues to grow, the need is crucial for all pharmacists to possess health informatics knowledge that will allow them to maintain their current responsibilities and adapt to meet future responsibilities.[3,4] Pharmacists who understand HIT within the framework of clinical care can help facilitate its effective use. In contrast, poor understanding can lead to unintended consequences impacting patient safety and quality of care.[5]

The pharmacy profession has many years of experience with HIT, having utilized computerized pharmacy information management systems and automation since the 1970s.[6] Thus, the profession is well-positioned for involvement in the implementation and use of HIT across practice settings.[5,7,8] The profession views the integration of pharmacists into the national HIT discussion as important, evidenced by the Pharmacy e-HIT Collaborative, a partnership of nine pharmacy professional organizations, who released "The Roadmap for Pharmacy Health Information Technology Integration in U.S. Health Care" in 2011.[9] This document provides a strategic plan for integrating pharmacy HIT into the national HIT movement and infrastructure. In order to achieve this goal, graduates must be prepared to engage with HIT regardless of practice setting. Thus, health informatics education needs to be integrated into the PharmD curriculum to prepare pharmacists for this evolving role with HIT, the aim of which would be to develop graduates who can not only manage clinical information but also understand technical needs.[6]

The Accreditation Council for Pharmacy Education (ACPE) Guidelines have identified informatics knowledge as a core competency required of pharmacy graduates in order to successfully transition to the practice environment. Guideline 12.1 identifies these competencies, which include, "basic terminology (data, information, knowledge, hardware, software, networks, information systems, information systems management); reasons for systematic processing of data, information, and knowledge in health care; and the benefits and current constraints in using information and communication technology in health care."[10] Additionally, among supplemental educational outcomes in

Corresponding Author: Kevin T. Fuji, PharmD, MA, 2500 California Plaza – Boyne 143C, Omaha, NE 68178. Tel: 402-280-4411. Fax: 402-280-4809. E-mail: kfuji@creighton.edu

the area of social and administrative pharmacy identified by the Center for the Advancement of Pharmaceutical Education (CAPE) is the need for graduates to identify, understand, and use various types of HIT including barcoding, computerized prescriber order entry systems, and automated drug distribution systems.[11]

A dearth of courses across PharmD programs provide instruction in health informatics. Flynn found that only 33% of pharmacy curricula included any courses in pharmacy informatics, and only half of these courses were required.[12] In 2008, Fox et al revealed similar findings, with only 29 of 80 PharmD programs (36%) indicating the presence of an informatics course.[13] To facilitate the teaching of health informatics, Flynn suggested identifying key concepts across existing informatics courses that should be integrated into a pharmacy informatics curriculum. To address the growing adoption and use of HIT and relative lack of courses addressing this content, we developed an elective course, built upon a rigorous and evidence-based approach to course development and evaluation. This paper describes the development of that elective health informatics course and its subsequent conversion to an online environment. The paper also presents lessons learned to provide a model that pharmacy educators can use to integrate this content into pharmacy curricula and evaluate effectiveness.

DESIGN

The health informatics course is a 2-credit, online elective semester-length course open to all pharmacy students regardless of year or educational pathway (online distance or in-person campus pathway) at the Creighton University School of Pharmacy and Health Professions. This inclusive approach was used as students in any year may be exposed to technology use, either through observation or direct hands-on contact. Initially, in fall 2009, the course was offered only to campus pathway students on Thursday evenings from 5:00 pm-6:50 pm. However, this meeting time was perceived as a barrier to current and future enrollment, with only 4 students completing the first course offering. Given this barrier and the instructors' interest in providing the content to students enrolled in the program's distance pathway, the course was converted to an online environment for future offerings. Distance education expands enrollment opportunities and eliminates schedule-related barriers.[3] The second offering in the spring of 2010 was an online course open only to distance pathway students to optimize the experience using feedback from students already experienced in online learning. Starting in spring 2011, course offerings were open to all pharmacy students in both educational pathways.

The 5 primary learning objectives for the course are displayed in Table 1, with course content and objectives for each lesson listed in Table 2. These topics were chosen using an evidence-based approach of providing course content within a framework of the ACPE Standards, CAPE Outcomes, and previously-identified key health informatics competencies.[13] Content was identified using the International Medical Informatics Association's recommendations for education in biomedical and health informatics, recommendations from the American Association of Colleges of Pharmacy's Technology in Pharmacy Education and Learning Special Interest Group, previously published literature describing similar courses in pharmacy and health informatics, and a literature review of HIT used in pharmacy practice. Search terms used in the review included pharmacy informatics, health informatics, pharmacy, pharmacy practice, and health information technology.[3,14,15] The course had no required textbook, and readings were selected from the published literature to familiarize students with seminal papers and to ensure that the most up-to-date information was being presented.[13] Students were assigned 1-2 required readings each week, and additional optional readings and resources were identified. Examples of required readings for each lesson are provided in Table 2. Ongoing research conducted by the instructors and their colleagues in health informatics was integrated into course content to highlight current research in the field and provide real-time exposure to lessons learned from this research. Active updating of course content took place throughout the semester as newly relevant information was made available from national research initiatives and policy-making organizations. Additionally, the final lecture of the course was dedicated to presenting emerging developments in health informatics and providing updates to earlier lectures.

The course was lecture-based with an embedded short discussion component. Students were asked to complete each week's readings prior to the class session. Each lecture began by identifying key health informatics acronyms relevant to that week's lesson, followed by a short discussion question to prompt students to reflect upon their current knowledge and perception of the lesson topic and to frame their thinking in the proper context for the lecture. Two to 4 additional short discussion questions were posed throughout each lecture to facilitate student discussion of key concepts and to allow the instructor to identify areas of difficulty for students. These short discussion questions were modeled after the one-minute paper classroom assessment technique: that is, students were asked to take one minute to write down a response to the short discussion question, followed by a small group discussion of their responses.[16]

Table 1. Learning Objectives for the Health Informatics Course

Learning Objective	Bloom's Taxonomy Level[a]
1. Identify health technologies commonly used in the provision of health care, and how these technologies impact the practice of pharmacy	1, 2, 3, 4, 5, 6
2. Describe the national focus and developments of health information technology and their impact on the pharmacy profession	1, 2, 3, 4, 5, 6
3. Identify current problems and future applications for the integration of informatics into pharmacy practice	1, 2, 3, 4, 5
4. Demonstrate the ability to discuss health technologies with other health care professionals for the common benefit of safe, quality patient care	1, 2, 3, 4, 5
5. Identify and apply course content to situations in which informatics is commonly used in pharmacy practice	1, 2, 3, 4

[a] Bloom's Taxonomy Levels: 1=knowledge; 2=comprehension; 3=application; 4=analysis; 5=synthesis; 6=evaluation

Voiced-over PowerPoint lectures were recorded weekly to translate the approach to an online environment. The same short discussion questions were embedded in each lecture, but in lieu of in-person discussion, students were asked to reflect upon each short discussion question and respond in written form each week. Students were provided with a Word document of each lesson's questions and were expected to type in their answers and submit their completed assignment to a drop box on the course website. Students could also use the Word document to ask questions or request clarification about lecture content. The course instructor read student responses and recorded a "feedback video" that was posted to the course website. The video was a voiced-over PowerPoint recording, in which the instructor identified student responses demonstrating understanding of key lesson concepts, allowed the instructor to further emphasize core content and clarify content students appeared to have difficulty with. New material was posted each Monday, with assignments due the following Sunday night. Feedback videos were posted each Wednesday for the previous week's assignment.

Quizzes and examinations were also converted to an online format, which could be completed anytime during a 5-day window. The online quizzes and examinations were not proctored, but an instructor review of access logs to examine discrepancies in test-taking time did not find any differences across offerings.

EVALUATION AND ASSESSMENT

Thirty-nine students completed the course through the first 5 course offerings (2009-2013), consisting of 4 students in the in-person course and 35 in the online course. Other than delivery mode, no significant changes were made to course content, allowing for aggregation of data across offerings. All assessments and evaluation tools were approved by the Creighton University Institutional Review Board. Descriptions of each assessment tool and associated student performance are presented. Although a standard course evaluation was also conducted, findings are omitted as the information provided was less detailed than the information obtained through the quantitative and qualitative assessments.

Students were assessed through typical quantitative measures: completion of discussion questions and performance on quizzes, examinations, and written papers. The value of each component was: discussion questions (10%), quizzes (10%), papers (20%), and examinations (60%). Overall, students averaged 92% in the course, with no substantial differences in averages across the 5 episodes of course offerings.

Three quizzes were administered throughout the course. Each quiz consisted of 10 multiple-choice questions, was designed to ensure students were keeping up with course content, and provided students with examples of question format and wording to be used on examinations. Quizzes were typically scheduled 1-2 weeks prior to an examination as a reminder of the upcoming examination and covered key content that would be included. Students averaged an 86% on quizzes. The slightly lower average on quizzes relative to students' overall course performance was expected because the relative weight of quizzes in the course was low—each one accounted for approximately 3.3% of the overall course grade.

Three examinations were administered at equal intervals throughout the course. Examinations consisted of multiple-choice, true-false, and short-answer questions designed to test student recall of core concepts and ability to provide brief explanations of core concepts (eg, identification and description of barriers to the adoption and use of electronic prescribing). Students averaged a 92% on examinations.

Students were assigned two 5-page literature review papers, given in each half of the course. The primary purpose of the papers was to allow students to explore a research problem impacted by HIT. Examples of paper

Table 2. Health Informatics Course Content, Objectives, and Sample Readings[a]

Lesson Title	Lesson Objectives	Sample Reading(s)
Introduction to Health Informatics	Introduce the different types of health technologies currently in use Describe the national focus on the adoption and use of health technologies Discuss how the introduction of these technologies have impacted the provision of health care	American Society of Health-System Pharmacists. ASHP statement on the pharmacist's role in informatics. *Am J Health-Syst Pharm*. 2007;64 (2):200–203.
The Role of Health Informatics in Pharmacy	Describe the expectation that pharmacists understand and use health informatics in practice Identify career opportunities for pharmacists in the field of informatics Describe how the health information technology movement has impacted pharmacy practice	Fuji KT, Galt KA. Pharmacists and health information technology: emerging issues in patient safety. *HEC Forum*. 2008;20(3):259-275.
The Nationwide Health Information Network (NwHIN), Regional Health Information Organizations, and Health Information Exchanges	Describe the purpose of the Nationwide Health Information Network Describe regional health information organizations, health information exchanges, and their relationship to the NwHIN Describe barriers to forming regional health information organizations and health information exchanges	Kuperman GJ. Health-information exchange: why are we doing it, and what are we doing? *J Am Med Inform Assoc*. 2011;18(5):678-682.
Electronic Health Records (EHRs)	Examine the differences between types of health records currently in use Provide an overview of the national focus on EHRs Discuss positive and negative consequences resulting from the use of EHRs Discuss the progress made in EHR adoption	Downard S, Galt KA, Reel AB. Pharmacists' use of electronic health records: silent leaders no more. *J Am Pharm Assoc*. 2007;47:680-692.
Systems Approaches to Health Informatics	Discuss the impact of human factors on systems Describe how HIT use is impacted by human factors Describe implementing HIT using a systems approach to patient safety and quality of care	No readings
Financial and Regulatory Considerations in Health Informatics	Review financial mechanisms for HIT funding Identify different organizations involved in the development of policies and standards for HIT	Chaudhry B, Wang J, Wu S, et al. Systematic review: impact of health information technology on quality, efficiency, and costs of medical care. *Ann Intern Med*. 2006;144(10):742-752.
Security, Privacy, and Ethical Considerations in the Use of Informatics	Review HIPAA and changes made in light of the increased use of electronic patient health information Discuss ethical issues that have emerged as a result of the increased national focus on HIT	Berner ES. Ethical and legal issues in the use of health information technology to improve patient safety. *HEC Forum*. 2008;20(3):243-258.

(*Continued*)

Table 2. (*Continued*)

Lesson Title	Lesson Objectives	Sample Reading(s)
Personal Health Records (PHRs)	Describe the different ways that patients currently keep track of health information Describe the different types of PHRs in use Discuss how HIT has impacted the move towards more patient-centered care	Tang PC, Ash JS, Bates DW, Overhage JM, Sands DZ. Personal health records: definitions, benefits, and strategies for overcoming barriers to adoption. *J Am Med Inform Assoc*. 2006;13(2):121-126.
Consumer Health Informatics	Present an overview of consumer health information resources and consumer health informatics applications Describe the issues with different types of patient literacy present in an increasingly digital age Discuss how the patient-provider relationship has evolved with the introduction of health technologies	Eysenbach G. Consumer health informatics. *BMJ*. 2000;320:1713.
Technology and the Medication Use Process	Describe the medication use process Identify what types of HIT are used during each stage of the medication use process	Hook J, Pearlstein J, Samarth A, Cusack C. *Using Barcode Medication Administration to Improve Quality and Safety: Findings from the AHRQ Health IT Portfolio*. Rockville, MD: Agency for Healthcare Research and Quality; 2008. Kuperman GJ, Bobb A, Payne TH, et al. Medication-related clinical decision support in computerized provider order entry systems: a review. *J Am Med Inform Assoc*. 2007;14(1):29-40.
E-Prescribing and Pharmacy Practice	Provide an overview of e-prescribing and the national adoption rates for e-prescribing Describe the impact of e-prescribing on prescribers and pharmacists Discuss the barriers to adoption of e-prescribing from the physician and pharmacist perspectives Provide an overview of recommendations presented to enhance current e-prescribing practices	Rupp MT, Warholak TL. Evaluation of e-prescribing in chain community pharmacy: best-practice recommendations. *J Am Pharm Assoc*. 2008;48 (3):364-370.
The Impact of Technology on Patient Safety	Discuss how the introduction and use of technology has positively and negatively impacted patient safety, quality, and efficiency of care	Ash JS, Berg M, Coiera E. Some unintended consequences of information technology in health care: the nature of patient care information system-related errors. *J Am Med Inform Assoc*. 2004;11 (2):104-112.
Telehealth	Present an overview of telehealth Discuss telepharmacy and other remote monitoring mechanisms Present an overview of mobile health	Casey MM, Sorensen TD, Elias W, Knudson A, Gregg W. Current practices and state regulations regarding telepharmacy and rural hospitals. *Am J Health Syst Pharm*. 2010;67(13):1085-1092.
Emerging Developments in Health Informatics	Discuss new implications in HIT that have occurred over the course of the semester	No readings

[a] Abbreviations: HIPAA=Health Insurance Portability and Accountability Act

topics included meaningful use programs for EHRs, pharmacy education efforts in health informatics, and the positive and negative consequences of electronic prescribing. Students were graded using a rubric that assigned 50 points based on 3 criteria: (1) content (25 points) – the degree to which the student comprehensively addressed the paper topic, including providing adequate background to describe the research problem, describing how health informatics either contributed to or addressed the research problem, and explaining how the research problem impacted the pharmacy profession; (2) writing style, readability, and grammar (20 points) – the degree to which the student presented the research problem in a clear and understandable manner, building logically through the standard format of introduction, methods, results, discussion, and conclusion; and (3) use of appropriate citations and AMA style (5 points) – the degree to which the student used appropriate references (eg, scientific journal articles rather than lay literature) and properly formatted these references using AMA style. Students averaged a 92% on papers.

Course effectiveness was assessed qualitatively using discussion questions, a goal-setting classroom assessment technique, and an end-of-course reflective question. These assessments were designed to provide instructors with a deeper understanding of student learning, and to identify specific course components valuable to students and areas for future course improvement. Additionally, qualitative assessments were designed to be complementary to quantitative assessments. The instructors recognized that traditional quantitative assessments such as quizzes and examinations would not sufficiently capture student learning. Students' own words better assess similarities and/or differences between quantitative student performance and perceived student learning.[17] Discussion questions were used during each lesson to solicit student thoughts on key course content presented in the lecture. This allowed the instructor to qualitatively assess student understanding of core concepts for each lesson and identify content areas requiring further explanation. An example discussion question was: "Given the requirements of providers to demonstrate 'meaningful use,' do you think the financial incentives will be enough to stimulate EHR adoption and use? Why or why not?" In this example, students were expected to discuss factors that could impact a provider's decision to adopt an EHR, such as practice size, location (eg, urban vs rural setting), and additional costs incurred beyond the purchase of the system itself (eg, staff training costs). Class discussion happened in real time in the in-person course and was addressed through the feedback video in the online course. Students received full credit for completing and turning in the assignment. Other than minor clarifications, student responses to the discussion questions did not indicate any difficulty grasping course content. All qualitative assessments were analyzed using a conventional content analysis approach.[18] For each qualitative assessment, all student responses were combined into a single document. This document was read over several times in order to get a better sense of the data. A basic coding process was then used to identify key perceptions of student learning and application to future practice. Codes describing similar ideas were combined together into overarching categories, and student responses representative of these categories were identified. This was an appropriate analytical approach for this course because relatively few standalone health informatics courses are currently offered across PharmD programs. Conventional content analysis does not impose pre-existing categories into the analysis framework, but instead allows findings to emerge from the data itself. Therefore, it allows educators to gain a deeper understanding of how students themselves express their understanding of the material and their perceptions of the material as it relates to the practice of pharmacy.

During the first week of the course, students were asked to write down 3 goals that they would like to achieve by the end of the semester and to rank order these goals from most important to least important.[16] Students were instructed to focus on learning goals and were asked not to identify performance goals such as "Get an A in the class." During the second class session of the in-person course, the instructor discussed student goals and compared/contrasted them with the instructor's goals. In the online course this was discussed during the feedback video for the first lesson. Typical student goals included gaining an overarching understanding of health informatics and the different types of technologies currently in use across health care settings, developing an understanding of how health informatics would impact future practice as a pharmacist and the role a pharmacist may have in implementing and using informatics. Some students had content-specific goals such as examining the use of EHRs in practice, addressing security and privacy concerns related to technology use, addressing issues of patient safety related to technology use in health care, using predictive analytics to enhance patient care, and learning more about informatics as a potential career option. Goals were revisited at the midway point of the course, and students were asked to self-evaluate their progress toward achieving the goals and ask the instructor for assistance in goal attainment if needed.

Goals were revisited again at the end of the course, and students were asked to provide a written assessment

of how well they met the goals. Responses to this assessment suggested positive perceptions of goal achievement, with 2 major categories standing out: breadth of HIT use and integration of HIT into pharmacy practice. Regarding breadth of HIT use, students reported gaining knowledge of the expansive nature of HIT and increasing pervasiveness of use. Regarding integration of HIT into pharmacy practice, students reported achieving an understanding of how HIT is integrated into pharmacy practice and how this changes practice role expectations and responsibilities.

Goals not achieved that the instructor could have addressed were evaluated for future course revisions. Long-term course revisions made as a result of this goal-setting classroom assessment technique included expanding a section on pharmacy informatics as a potential future career option and loosening restrictions on paper topics. Originally, only content covered in the half of the course in which the paper was due could be used for paper topics (ie, the first paper topic had to be covered in lessons 1-7, while the second paper topic had to be covered in lessons 8-14). In order to facilitate further exploration of course content, the instructor removed this restriction to allow students to choose any topic covered in the course and then further expanded it to allow any health informatics-related topic to be used, including those not covered in the course. This resulted in paper topics such as the use of predictive analytics and big data for quality improvement initiatives and the increasing use of biomedical informatics and its role in personalized medicine.

During the last week of the course, a single reflection question was posed to students: "How do you think the knowledge you have gained regarding health informatics will help you in the future as a practicing pharmacist?" Representative responses to this reflection question fell into 3 major categories: HIT integration into pharmacy practice, possessing a common language of informatics, and the importance of foundational knowledge.

Regarding HIT integration into pharmacy practice, students gained a greater overall understanding of the different types of HIT in use and how it applies to pharmacy practice, exemplified by this comment: "The most valuable thing was learning how HIT fits into the medication use process. Before this class I considered the benefits of e-prescribing and how that improves patient safety to be the main form of HIT benefiting pharmacies. Now I have a much better, big-picture view of HIT and how it fits into the different steps taken in evaluating patients, prescribing, filling medications, dispensing and administering them, and monitoring the patients' treatments." In terms of possessing a common language of informatics, students described how the knowledge they gained will be translatable regardless of their future practice setting and necessary for being actively involved in discussions regarding HIT use in practice: "I have already noticed my expanded knowledge on this topic and application of HIT language in discussions with people involved in health care. I believe it will allow me to better operate and teach others how to use the different types of HIT as I will understand what functions and limitations they present to the health care system. I believe it will help me communicate more effectively and efficiently with other health care providers as I will fully understand what they are talking about concerning HIT."

Finally, regarding the importance of foundational knowledge, students recognized the importance of possessing foundational knowledge in the use of HIT and various national HIT initiatives: "I feel much more informed as to the many ways that technology is used in the healthcare setting, and the perspectives of providers, organizations, and patients. I also feel well-equipped so that I can keep up with HIT changes as we move forward with Meaningful Use and other HIT campaigns."

DISCUSSION

This course development and evaluation approach helped students attain foundational knowledge they will need as they encounter and engage with technologies in the provision of patient care. A representative student comment emphasized the value of this content for students and illustrates the need for a continuing push to integrate it into required curricula: ". . . I could not be happier I took this class. I feel I will benefit a lot from the information gained in this course when I am a practicing pharmacist."

This approach also demonstrated that an in-person course in health informatics can be converted over to an online format and be equally effective in delivery of core course content, a finding consistent with the development of another online health informatics course.[14] While the benefit of an online course is that content is highly accessible to students and not subject to potential scheduling barriers that may limit student enrollment, it only resulted in very modest increases in student enrollment. This highlights the difficulty of engaging students in this topic area.

This course can provide a framework to identify content using an evidence-based approach and identify qualitative techniques to provide a deeper understanding of course effectiveness and student learning, and present suggestions for keeping course material timely and up to date. The content included many didactic sample learning activities identified by Fox et al that incorporate pharmacy informatics into the curriculum. As such, it can provide another template for either integrating this content into existing courses or developing stand alone health informatics courses for PharmD students.[19] Additionally,

a number of both free and fee-based online health informatics courses and open initiatives are available to educators (Appendix 1).[20-23] While it is likely that no single course will meet the needs of all schools and colleges, examining the multitude of health informatics resources available and learning from what others have already developed can facilitate providing the best possible health informatics education to pharmacy students.

Given the expansive nature of health informatics and its nascent integration into PharmD curricula, it is important to allow students the opportunity to pursue additional learning. This may include exploring topics that are outside the scope of a foundational course. These opportunities provide mechanisms for engaging students and helping them further understand why health informatics is important for their future practice. It may also help instructors identify topics for future course integration. Additional assessments that could advance health informatics educational efforts include: examining students' perceptions of the role of HIT in pharmacy practice and whether courses such as the one described in this paper facilitate effective HIT use, conducting a longitudinal examination of course effectiveness through postgraduate assessment of students' continuing education in health informatics, and examining actual use of the knowledge obtained in the course to various practice settings.

The iterative and ongoing process of updating and revising content is necessary for optimal health informatics instruction.[19] The rapidly changing field of pharmacy and ongoing research and policy advancement force instructors to stay on the cutting edge of this area to provide students with information relevant to future practice. This includes changing lectures during the course offering and finding mechanisms to present developments that have emerged throughout the semester (eg, using the final lecture to help students keep abreast of what has happened). Although not explicitly done for our course, educators should map course content, course objectives, and lesson objectives to ACPE Standards and CAPE Outcomes to ensure course revision adequately prepares graduates for engagement with HIT in practice.

Finally, this is a didactic approach with no hands-on experiences for students, which is an important component for students with limited work experience and not familiar with use of these technologies in practice. Didactic courses in health informatics should be supplemented by hands-on observation and experience during introductory pharmacy practice experiences and advanced pharmacy practice experiences.

SUMMARY

The growing use of HIT requires increased pharmacist knowledge of health informatics regardless of practice setting. As pharmacists' roles and involvement with HIT continue to evolve, pharmacy graduates must be prepared to engage it appropriately within their practice to ensure safe, quality care for patients. While an online course is one mechanism for providing this education and may be equally as effective as an in-person course, lessons learned from the development of this course can be applied to integrate the content into existing courses as well. Pharmacy educators must continue to place value on this education and share successful practices with one another to facilitate its teaching across PharmD curricula.

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Appendix 1.
Health Informatics Educational Programs and Materials

Free Online Resources

Partners in E – Developed by the University of California-San Francisco School of Pharmacy; designed to help pharmacy educators meet ACPE standards.

Health IT Workforce Curriculum – Lectures and educational materials developed through grants provided by the Office of the National Coordinator for Health Information Technology; designed to educate health IT workers to help health care providers adopt and effectively use EHRs.

Interprofessional Healthcare Informatics course – Massive open online course offered through Coursera and run by the University of Minnesota.

Fee-Based Online Resources

American Medical Informatics Association 10x10 courses – Each course covers a different aspect of health informatics, including clinical informatics, interface design, and patient safety related to HIT.