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Educating 10,000 informaticians by 2010: The AMIA 10 × 10 program

William Hersh^{a,*}, Jeffrey Williamson^b

^a Oregon Health & Science University, Portland, OR, USA

^b American Medical Informatics Association, Bethesda, MD, USA

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ABSTRACT

Objectives: There is an increasing need for a larger and better trained workforce in medical informatics. The goal of the American Medical Informatics Association 10 × 10 program is to educate 10,000 clinicians in medical informatics by the year 2010.

Methods: We adapted an on-line introductory graduate course toward this goal. It was evaluated using Likert-scale and open-ended questions.

Results: The course was successfully implemented and attracted 51 individuals, 44 of whom completed it. The evaluation was generally positive, with all but one Likert-scale above 4.0 on a 1-to-5 scale.

Conclusions: We successfully adapted an introductory medical informatics course to a larger audience. The evaluation showed it was received positively and we have further plans to scale it to an even larger audience to meet the goals of the 10 × 10 program.

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1. Introduction

Despite numerous studies demonstrating the value of health information technology (HIT) in improving the quality, safety and efficiency of health care [1], there are still many recognized barriers to achieving its benefits on a larger scale [2]. While economic challenges tend to be the most commonly cited impediments [3], it is increasingly recognized that a well-trained work force is also a barrier [4].

In the United States, most educational programs in medical informatics have focused on training researchers [5]. This is despite the fact that opportunities for researchers are limited and there is major opportunity for health care professionals assuming operational informatics roles [6]. The biomedical informatics educational program at Oregon Health and Science University (OHSU) came to understand the need for and interest in training in applied informatics driven by the inter-

ests of its students [7]. A big part of that interest came from the program's foray into distance education in 1999, which created opportunities for informatics education to a much wider audience [8]. To date, over 400 individuals have matriculated in distance learning courses at OHSU.

The American Medical Informatics Association (AMIA) has also recognized the growing interest in applied informatics. Seeking to establish its appropriate role as a leader for all informaticians in health care, AMIA also began to ponder the role it should play in providing education for informaticians, balancing its role in advocacy of the field versus representing the interests of academic programs that contribute a large proportion of its membership and leadership. Dr. Charles Safran, Chairman of the Board of Directors of the American Medical Informatics Association, has advocated that we need at least one physician and nurse each at all 6000 hospitals in the United States to guide HIT implementation [9]. Recently, the

* Corresponding author at: Department of Medical Informatics & Clinical Epidemiology, School of Medicine, Oregon Health & Science University, BICC, 3181 SW Sam Jackson Park Road, Portland, OR 97239, USA. Tel.: +1 503 494 4563; fax: +1 503 494 4551.

E-mail address: hersh@ohsu.edu (W. Hersh).

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American Medical Informatics Association (AMIA) and American Health Information Management Association (AHIMA) issued a call for increasing the size and scope of the HIT workforce [4].

The interests of OHSU and AMIA converged in early 2005, when it was recognized that the introductory course of the former could be generalized and promoted to a wider audience by the latter in a way that provided benefit to both and did not undermine traditional academic programs. In fact, it was recognized that such a partnership could promote academic informatics programs in providing exposure to the field for a wider audience, some of whom would pursue more advanced study in the academic programs. In order to not play favorite to a single academic program, the AMIA 10 × 10 program was designed to allow any academic or other organization to provide introductory courses, with OHSU designated as the inaugural partner. An internal process has since been established within AMIA to vet other partners. In this paper, we describe the implementation and evaluation of the initial 10 × 10 offering.

2. Implementation

The goal of the OHSU introductory course has always been to broadly survey the field, aiming to describe the use of IT from the vantage of common principles. For the 10 × 10 course, we added two additional topics as well as an in-person session to the introductory course (see Table 1). We also assessed the competencies that could be expected from a course like this and matched them to the content (see Table 2).

The on-line portion of the course uses a variety of teaching modalities that have been honed through experience and student feedback over the years. These include:

- Voice over Powerpoint lectures.
- Threaded discussion boards.
- Reading assignments.
- Self-assessment quizzes.
- Course project.

All of these teaching modalities are delivered in the Blackboard Learning System (www.blackboard.com), a commercial course delivery tool. The OHSU program actually does very

Table 1 – The 12 units of the on-line portion of the 10 × 10 course

- (1) Overview of discipline and its history
- (2) Biomedical computing
- (3) Electronic health records and health information exchange
- (4) Decision support: evolution and current approaches
- (5) Standards: privacy, confidentiality and security
- (6) Evidence-based medicine and medical decision-making
- (7) Information retrieval and digital libraries
- (8) Bioinformatics
- (9) Imaging informatics and telemedicine
- (10) Consumer health, nursing, public health informatics
- (11) Organization and management issues in informatics
- (12) Career and professional development

Table 2 – Competencies that the 10 × 10 program aims to impart

- The value proposition of health information technology and how medical informatics and other fields contribute to it
- The role of various individuals in the health information technology workforce
- The basic tenets of biomedical computing to enable optimal selection of hardware, software and network connections for a given setting
- The essential functions of the electronic health record (EHR), the barriers to its use
- The principles of implementing EHRs in ambulatory, hospital and other settings
- The role of clinical decision support in health care settings and within the EHR
- Computerized provider order entry and how it enhances clinical decision support
- The basic principles of health care quality assessment, including pay for performance programs and how the EHR enables them
- The role of health information exchange and Regional Health Information Organizations (RHIOs)
- The personal health record (PHR), its interface with the EHR and its value in promoting personal health
- The importance of standards and interoperability of clinical data and the major initiatives underway
- Maintaining privacy, confidentiality and security, including the role of HIPAA
- The core principles of evidence-based medicine and their application in clinical practice
- Accessing medical knowledge resources and linking them to clinical practice
- People and organizational issues in the use of health information technology
- The unique aspects of nursing information and practice in relation to clinical information systems
- The growing impact of genomics on medicine and its implications for health information systems
- The management of images in clinical settings, including the use of PACS systems
- The role of telemedicine and barriers to its use
- The function of public health information systems and their interaction with clinical systems
- The key issues in organizational, project and business management in informatics projects and the notion that informatics projects require more than an understanding of technology
- Career and professional development in the informatics field

little specific to Blackboard, but finds it a useful system for managing users, delivering on-line content and protecting it from unauthorized access.

Voice over Powerpoint lectures provide the core of the material. When done well, lectures have the effect of adding explanation to the information that goes beyond purely written materials [8]. The OHSU program has used a variety of products for these lectures over the years, settling most recently on a tool by Articulate (www.articulate.com) that not only provides great flexibility in the editing process (such as slide-by-slide recording) but produces finished content in the Macromedia Flash format, which is easily streamed over the Internet. The Flash presentation allows navigation by single slides. Fig. 1 shows a screen shot of a slide from a lecture. Students are also provided a PDF of the slides in handout format they can print for taking notes on and/or archiving.

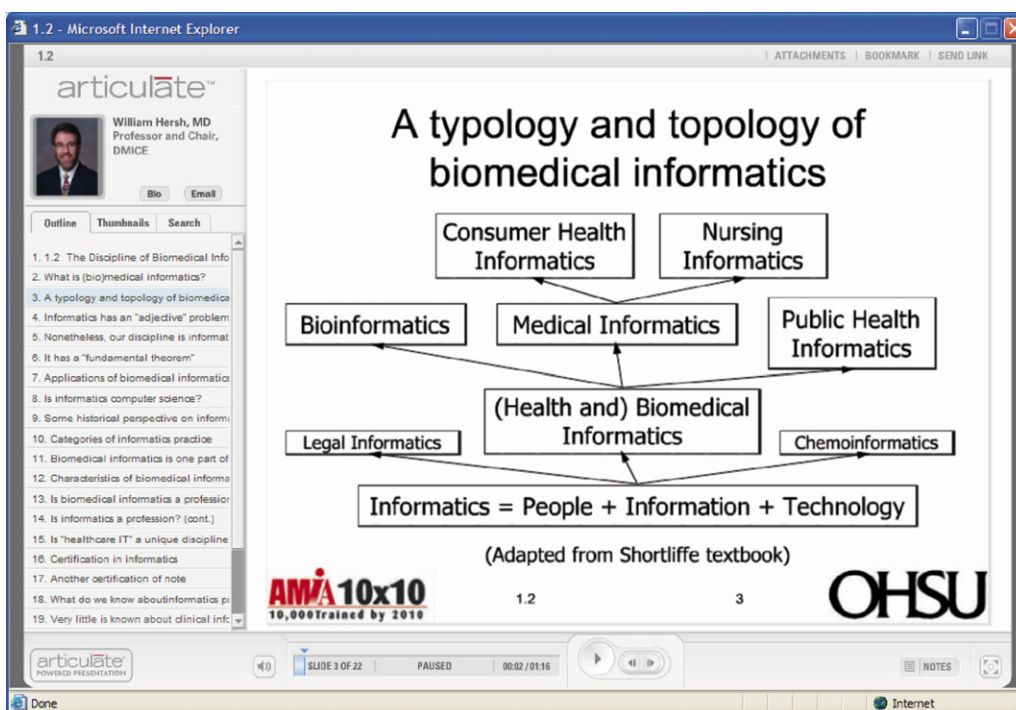


Fig. 1 – Screen shot of slide from lecture.

Table 3 lists the detailed outline for the course, with each item representing 10–40 min of lecture.

Interaction is an important part of all distance learning courses at OHSU, and the introductory course makes use of the threaded discussion capability of Blackboard. In each unit of the course, the instructor develops two to four discussion questions that cover issues important and amenable to discussion. Different on-line instructors handle on-line interaction differently, but we have generally found that the best approach is to post the initial discussion questions and allow student interaction and threads to develop, with occasional comment from the instructor, especially if the discussion gets off-track. Our early experience with on-line discussion found it to be more interactive than classroom discussion [8].

Readings are also assigned to students. Like many introductory courses, we used the textbook by Shortliffe and Cimino, now in its third edition [10]. Additional readings are provided electronically, consisting of articles in PDF form or via links to Web sites.

Another teaching modality is self-assessment quizzes. In each unit, ten multiple-choice questions are provided that aim to assess student knowledge on the most important topics of the unit. As the Blackboard System has the ability to deliver and grade multiple-choice quizzes, the grading and tracking of results is made easy. The system can also deliver an explanation when an answer is incorrect, enabling the correct answer to be explained to the student.

The final teaching modality is the course project. This is a small project where students are asked to do an environmental assessment in their vicinity, e.g., medical practice, hospital or other setting. They are instructed to identify an informatics application that is available or being contemplated, and apply what they have learned in the course to determine the

goals of the implementation, how it is being done and how ready the intended audience is for the application. They are told that they will present their project to a small group of fellow students to discuss common themes across the project.

After 12 units of on-line learning, the course culminates with the in-person session. The actual format of this final session has varied, but it has always included some combination of the following activities:

- Introductions, with the goal of meeting their on-line classmates and the instructor face-to-face.
- Advanced lectures that provide breaking updates on the material and demonstrate its application.
- Small group discussion.
- Feedback and future directions.

In the offering associated with the AMIA Annual Symposium, the advanced lectures were replaced by free admission to tutorials at the meeting. At other meetings, experts in the field have been recruited to speak on recent developments, such as new government initiatives and legislation in the HIT area. The final component of feedback and future directions allows the students the chance to provide feedback on the course. It also allows them to discuss with the instructor their own future growth and involvement in the field.

One of the advantages to basing the 10 × 10 course on the existing introductory course is that it provides students a direct pathway to further informatics education. In fact, those who complete the OHSU 10 × 10 and subsequently enroll in the OHSU graduate program can get credit for the introductory course by obtaining a passing grade on the final examination. This then enables them to take further courses in the OHSU program. One of the original visions for the 10 × 10 program

Table 3 – Detailed outline of course content

- (1) Overview of discipline and its history
 - (1.1) A discipline whose time has come
 - (1.2) The discipline of biomedical informatics
 - (1.3) Problems in health and biomedicine motivating biomedical informatics
 - (1.4) Seminal documents and reports
 - (1.5) Resources of field
- (2) Biomedical computing
 - (2.1) Types of computers
 - (2.2) Data storage in computers
 - (2.3) Computer hardware and software
 - (2.4) Computer networks
 - (2.5) Software engineering
 - (2.6) Challenges for biomedical computing
- (3) Electronic health records
 - (3.1) Clinical data
 - (3.2) History and perspective of the health (medical) record
 - (3.3) Potential benefits of the electronic health record
 - (3.4) Definitions and key attributes of the HER
 - (3.5) EHR examples
 - (3.6) Current status of the EHR
 - (3.7) Health information exchange
- (4) Decision support and health care quality
 - (4.1) Historical perspectives and approaches
 - (4.2) Health care quality
 - (4.3) Medical errors and patient safety
 - (4.4) Approaches to improving quality and safety
 - (4.5) Reminders and alerts
 - (4.6) Computerized provider order entry (CPOE)
- (5) Standards, privacy and security; costs and implementation
 - (5.1) Standards: basic concepts
 - (5.2) Identifier and transaction standards
 - (5.3) Message exchange standards
 - (5.4) Terminology standards
 - (5.5) Privacy, confidentiality and security: basic concepts
 - (5.6) HIPAA privacy and security regulations
 - (5.7) Cost-benefit of the EHR
 - (5.8) Implementing the EHR
- (6) Evidence-based medicine and medical decision-making
 - (6.1) Definitions and application of EBM
 - (6.2) Interventions
 - (6.3) Diagnosis
 - (6.4) Harm and prognosis
 - (6.5) Summarizing evidence
 - (6.6) Putting evidence into practice
 - (6.7) Limitations of EBM
- (7) Information retrieval and digital libraries
 - (7.1) Information retrieval
 - (7.2) Knowledge-based information
 - (7.3) Content
 - (7.4) Indexing
 - (7.5) Retrieval
 - (7.6) Evaluation
 - (7.7) Digital libraries
- (8) Bioinformatics
 - (8.1) Overview of basic molecular biology
 - (8.2) Important biotechnologies driving bioinformatics
 - (8.3) Genetics-related diseases
 - (8.4) Bioinformatics information resources
 - (8.5) Informatics challenges and opportunities for molecular biology

Table 3 (Continued)

- (9) Imaging informatics and telemedicine
 - (9.1) Imaging in health care
 - (9.2) Modalities of imaging
 - (9.3) Image management
 - (9.4) Telemedicine: definitions and barriers
 - (9.5) Efficacy of telemedicine
- (10) Other informatics: consumer health, public health and nursing
 - (10.1) Consumer health informatics overview
 - (10.2) Consumer information access and decision-making
 - (10.3) Consumer-provider communication
 - (10.4) Personal health records
 - (10.5) New models of health care
 - (10.6) Public health informatics
 - (10.7) Nursing informatics
- (11) Organization and management issues in informatics
 - (11.1) Organization behavior
 - (11.2) Organizational issues in failure and success of informatics projects
 - (11.3) Change management
 - (11.4) Project management
 - (11.5) Business issues in informatics
- (12) Career and professional development
 - (12.1) Disciplines and professions
 - (12.2) Competencies in informatics practice
 - (12.3) Professional organizations in informatics
 - (12.4) Future trends in informatics careers and professional development

is that students would be able to get credit and enroll in any informatics graduate program.

3. Evaluation

We report here the evaluation of the first offering of the AMIA-OHSU course that took place in the summer and fall of 2005. The on-line portion of the course began in late July, with weekly posting of units over the ensuing 12 weeks. Students then came together for the in-person session at the AMIA 2005 Annual Symposium in November 2005. A total of 51 individuals enrolled in the course, with 44 completing all of the materials and receiving AMIA's certificate of completion.

The career backgrounds of those in the initial course are shown in Table 4. As can be seen, the largest demographic was

Table 4 – Backgrounds of students enrolled in initial course

Background	N
Physician (MD, DO)	24 (9 in CMIO or other informatics role already)
IT	7
Nursing (RN)	5
Laboratory technician	2
Statistician	2
Pharmacist	1
Respiratory therapist	1
Health information administrator (RHIA)	1
Sports physiologist	1

Table 5 – Likert-scale evaluation questions (24 respondents)

Evaluation questions	Minimum	Mean	Median	Maximum
Did the content of this 10 × 10 course match what was described in the description?	4.00	4.74	5.00	5.00
This 10 × 10 course provided me with practical information that applies in my practice and/or employment setting	3.00	4.43	5.00	5.00
This 10 × 10 course was well balanced and educationally stimulating	3.00	4.61	5.00	5.00
The instructors exhibited a thorough knowledge of the subject matter	4.00	4.96	5.00	5.00
The instructors presented the subject matter in a well-organized manner	4.00	4.96	5.00	5.00
The instructors responded well and in a timely manner to questions	4.00	4.87	5.00	5.00
The length of the course was appropriate	4.00	4.65	5.00	5.00
The course materials were presented effectively and easy to navigate	3.00	4.41	4.00	5.00
This 10 × 10 course met my expectations	3.00	4.52	5.00	5.00
I would recommend this course to my colleagues	3.00	4.57	5.00	5.00
My rating of the e-learning portion of this 10 × 10 course	3.00	4.57	5.00	5.00
My rating of the in-person portion of this 10 × 10 course	2.00	3.86	4.00	5.00
My overall rating of this 10 × 10 course	3.00	4.61	5.00	5.00

physicians, who comprised over half of those who responded. Nine of the 24 physicians already had substantial informatics activity in their jobs, with 3 reporting their title as chief medical information officer. While most of the students were from North America, others were from as far away as Argentina and Taiwan.

The tuition for the course was US\$ 2000. Some students had their tuition paid by their employer. As with our existing introductory course, we told students to expect a workload of 2–3 h per week of lectures plus an additional 4–6 h for reading assignments, on-line discussion and completion of homework quizzes. Unlike the introductory course, there was no final examination. However, the grades on the homework quizzes were very similar to those obtained by 50 students taking the regular introductory course in the OHSU graduate program simultaneously (average and standard deviation for 10 × 10 students was $83.6 \pm 8.5\%$ compared to $85.7 \pm 10.8\%$ for the regular course).

Specific aspects of the course were evaluated with both Likert-style and open-ended questions. The results of the Likert-scale questions are shown in Table 5. On a scale of 1 (low) to 5 (high), the results of the various questions were uniformly positive. Table 6 shows responses to a question asking the most appropriate outcome from material taught in the course. Analysis of the open-ended questions provided

feedback on aspects of the course that could be changed or improved. The enthusiasm for the in-person session was not universal, and several wondered whether it was productive use of their time. A number of others voiced support for expansion of some material in the course, particularly around the topic of electronic health records, although a number of others complained the material was too overwhelming for an introductory course.

4. Future directions

Since the initial offering, the course has been offered several more times. A special offering was funded and made available to California clinicians by the California Healthcare Foundation, with 21 individuals enrolling and 16 completing the course. A second general AMIA offering was launched in the winter of 2006, with 70 individuals enrolling and 59 completing the course. The course has also been translated into Spanish by Hospital Italiano in Buenos Aires, Argentina and offered to a Latin America audience. Additional offerings are also planned in 2007 in partnership with the American College of Physicians and the Scottsdale Institute. Furthermore, AMIA has also signed on one additional partner offering a 10 × 10 course, the University of Alabama at Birmingham.

Table 6 – What would be the most appropriate outcome in using information gained in this course?

Preparation for implementing an electronic health record system	9
Preparation for using an electronic health record	7
Preparation for assuming a new role such as chair of informatics committee or physician/nurse champion, etc.	10
Other, please specify	5
<ul style="list-style-type: none"> • As a foundation for more advanced learning in biomedical informatics • As a general knowledge base for future study in informatics • Intro to become a team member of a department such as CDS • Maintaining and expanding knowledge as EHR clinical champion • Provide a basis for health professionals (not just clinicians, but epidemiologists, behavioral scientists, biostatisticians, etc.) to gain the skills needed to introduce and help integrate informatics thinking, content, methods, into our particular health profession whether that is academic public health teaching and research, health care, or community or governmental organization that is related to health care and/or public health 	
Number of respondents was 31.	

Our experience has shown that an intensive introduction to medical informatics can be delivered via distance learning. The material can be delivered using standard Internet technologies and result in enthusiastic acceptance. We also believe that research could be helpful in determining the best content and modalities for expanding the HIT workforce.

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