A Quarter-Century of Innovation in Informatics Education at OHSU: History and Lessons Learned

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References

Anonymous (2008). Information Behaviour of the Researcher of the Future. London, England, Centre for Information Behaviour and the Evaluation of Research. http://www.jisc.ac.uk/media/documents/programmes/reppres/ggworkpackageii.pdf

Detmer, DE and Shortliffe, EH (2014). Clinical informatics: prospects for a new medical subspecialty. *Journal of the American Medical Association*. 311: 2067-2068.

Feldman, SS and Hersh, W (2008). Evaluating the AMIA-OHSU 10x10 program to train healthcare professionals in medical informatics. *AMIA Annual Symposium Proceedings*, Washington, DC. American Medical Informatics Association. 182-186.

Gadd, CS, Williamson, JJ, et al. (2016). Eligibility requirements for advanced health informatics certification. *Journal of the American Medical Informatics Association*. 23: 851-854.

Gadd, CS, Williamson, JJ, et al. (2016). Creating advanced health informatics certification. *Journal of the American Medical Informatics Association*. 23: 848-850.

Greiner, AC and Knebel, E, Eds. (2003). Health Professions Education: A Bridge to Quality. Washington, DC, National Academies Press.

Hersh, W (2009). A stimulus to define informatics and health information technology. *BMC Medical Informatics & Decision Making*. 9: 24. http://www.biomedcentral.com/1472-6947/9/24/

Hersh, W, Biagioli, F, et al. (2017). From Competencies to Competence: Model, Approach, and Lessons Learned from Implementing a Clinical Informatics Curriculum for Medical Students. Health Professionals' Education in the Age of Clinical Information Systems, Mobile Computing and Social Networks. A. Shachak, E. Borycki and S. Reis. Amsterdam, Netherlands, Elsevier**:** in press.

Hersh, W and Williamson, J (2007). Educating 10,000 informaticians by 2010: the AMIA 10×10 program. *International Journal of Medical Informatics*. 76: 377-382.

Hersh, WR (2007). The full spectrum of biomedical informatics education at Oregon Health & Science University. *Methods of Information in Medicine*. 46: 80-83.

Hersh, WR, Gorman, PN, et al. (2014). Beyond information retrieval and EHR use: competencies in clinical informatics for medical education. *Advances in Medical Education and Practice*. 5: 205-212. http://www.dovepress.com/beyond-information-retrieval-and-electronic-health-record-use-competen-peer-reviewed-article-AMEP
Hersh, WR, Junium, K, et al. (2001). Implementation and evaluation of a medical informatics distance education program. *Journal of the American Medical Informatics Association*. 8: 570-584.
Kulikowski, CA, Shortliffe, EH, et al. (2012). AMIA Board white paper: definition of biomedical informatics and specification of core competencies for graduate education in the discipline. *Journal of the American Medical Informatics Association*. 19: 931-938.
Longhurst, CA, Pageler, NM, et al. (2016). Early experiences of accredited clinical informatics fellowships. *Journal of the American Medical Informatics Association*. 23: 829-834.
Otero, P, Hersh, W, et al. (2010). A medical informatics distance-learning course for Latin America - translation, implementation and evaluation. *Methods of Information in Medicine*. 49: 310-315.
Safran, C, Shabot, MM, et al. (2009). ACGME program requirements for fellowship education in the subspecialty of clinical informatics. *Journal of the American Medical Informatics Association*. 16: 158-166.
Skochelak, SE, Hawkins, RE, et al., Eds. (2017). Health Systems Science. New York, NY, Elsevier.
Valenta, AL, Meagher, EA, et al. (2016). Core informatics competencies for clinical and translational scientists: what do our customers and collaborators need to know? *Journal of the American Medical Informatics Association*. 23: 835-839.
Williamson, JJ (2011). Evaluation of AMIA 10x10 Continuing Education Initiative. M.Ed. Master'sThesis, University of Virgina.

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Disclosures

- No relevant financial or commercial interests or disclosures to report
- That said, I teach informatics for a living

Learning objectives

- Define the field and sub-areas of biomedical and health informatics
- Describe competencies in informatics for different learners
- Discuss the OHSU informatics educational programs
- Describe the lessons learned from 25 years of experience
- Demonstrate examples of scholarship emanating from our work

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Outline

- Definitions of biomedical informatics and related topics
- Competencies for diverse learners
- Accomplishments of OHSU informatics educational program
- Lessons learned

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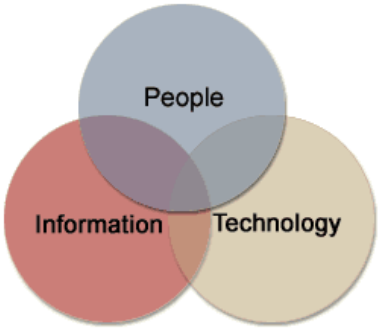
What is biomedical/clinical/health informatics (Hersh, 2009)?

- *Biomedical and health informatics* is the field concerned with the optimal use of information, often aided by technology, to improve individual health, healthcare, public health, and biomedical research
  - Informatics applied in a more focused domain is {X} informatics, e.g., nursing, dental, pathology, primary care, etc.
- Practitioners of informatics called *informaticians* (sometimes *informaticists*)



(SUNY Buffalo)

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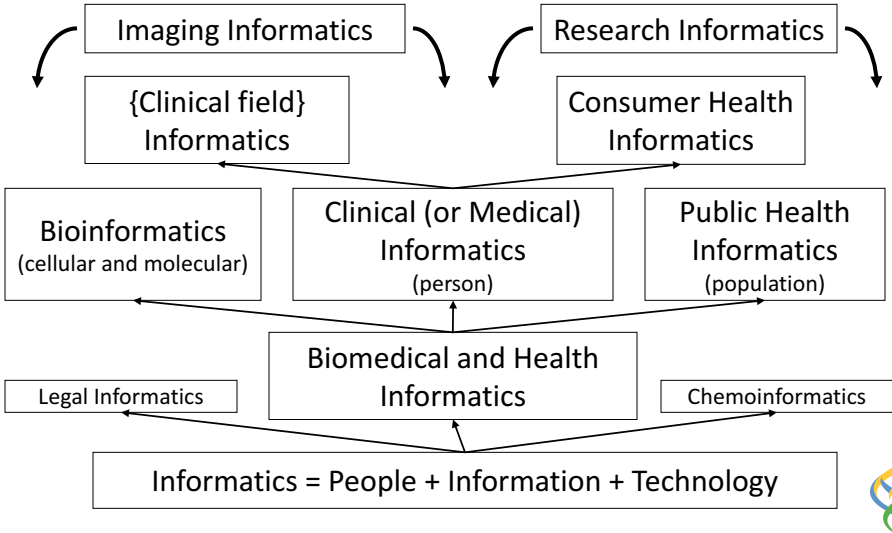
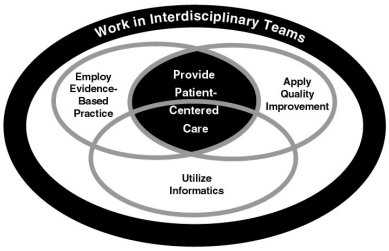
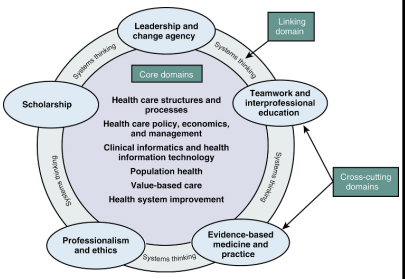
Informatics has an "adjective problem" (Hersh, 2009)



Informatics is a core competency for health professionals

- According to Institute of Medicine, modern healthcare professionals must have competence in informatics as part of larger goal to provide patient-centered care (Greiner, 2003)
- Informatics competence is not just computer literacy
  - The "Google generation" does not necessarily have good information skills (CIBER, 2008)
- Clinical informatics is a core domain of "health systems science" (Skochelak, 2017)





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Important to medicine is clinical informatics

- In 2011, clinical informatics approved by ABMS as first subspecialty of all specialties (Detmer, 2014)
  - Administrative home is American Board of Preventive Medicine
- First board exam offered in 2013
  - Over 1400 certified now
- Board eligibility during grandfathering period through initially 2017, now 2022
  - After which only path to board eligibility will be ACGME-accredited fellowship

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Informatics is not just about physicians

- Informatics professionals come from all health professions and non-health professions (e.g., computer science, IT, and more)
  - AMIA developing Health Informatics Certification (AHIC) for other health professionals in informatics (Gadd, 2016; Gadd, 2016)
- Informaticians play professional and academic roles in all missions of healthcare organizations, industry, and academia
  - Research, education, and operations

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Diverse competencies for diverse roles

- Informaticians
- Clinicians
- Researchers

- But some foundational elements for all

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Core competencies of biomedical informatics (Kulikowski, 2012)

Acquire professional perspective	Summarize and explain the history and values of the discipline and its relationship to related fields while demonstrating an ability to read, interpret, and critique the core literature
Analyze problems	Analyze, understand, abstract, and model a specific biomedical problem in terms of data, information and knowledge components
Produce solutions	Use the problem analysis to identify and understand the space of possible solutions and generate designs that capture essential aspects of solutions and their components
Articulate the rationale	Defend the specific solution and its advantage over competing options
Implement, evaluate, and refine	Demonstrate an ability to carry out the solution, to assess its validity, and iteratively improve its design
Innovate	Create new theories, typologies, frameworks, representations, methods, and processes to address biomedical and informatics problems
Work collaboratively	Demonstrate the ability to team effectively with partners from diverse disciplines
Disseminate and discuss	Communicate effectively to audiences in multiple disciplines in persuasive written and oral form

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Competencies for clinical informatics professionals (Safran, 2009)

- Search and appraise the literature relevant to clinical informatics
- Demonstrate fundamental programming, database design, and user interface design skills
- Develop and evaluate evidence-based clinical guidelines and represent them in an actionable way
- Identify changes needed in organizational processes and clinician practices to optimize health system operational effectiveness
- Analyze patient care workflow and processes to identify information system features that would support improved quality, efficiency, effectiveness, and safety of clinical services
- Assess user needs for a clinical information or telecommunication system or application and produce a requirements specification document
- Design or develop a clinical or telecommunication application or system
- Evaluate vendor proposals from the perspectives of meeting clinical needs and the costs of the proposed information solutions
- Develop an implementation plan that addresses the sociotechnical components of system adoption for a clinical or telecommunication system or application
- Evaluate the impact of information system implementation and use on patient care and users
- Develop, analyze, and report effectively (verbally and in writing) about key informatics processes

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PERSPECTIVES

Beyond information retrieval and electronic health record use: competencies in clinical informatics for medical education

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Abstract: Physicians in the 21st century will increasingly interact in diverse ways with information systems, requiring competence in many aspects of clinical informatics. In recent years, many medical school curricula have added content in information retrieval (search) and basic use of the electronic health record. However, this omits the growing number of other ways that physicians are interacting with information that includes activities such as clinical decision support, quality measurement and improvement, personal health records, telemedicine, and personalized medicine. We describe a process whereby six faculty members representing different perspectives came together to define competencies in clinical informatics for a curriculum transformation process occurring at Oregon Health & Science University. From the broad competencies, we also developed specific learning objectives and milestones, an implementation schedule, and mapping to general competency domains. We present our work to encourage debate and refinement as well as facilitate evaluation in this area.

In reality, applicable to all healthcare professional students.

(Hersh, 2014)

Table 9.2 Competencies in Clinical Informatics for Health Care Professionals

1. Find, search, and apply knowledge-based information to patient care and other clinical tasks
   a. Information retrieval/search: Choose correct source for specific task, search using advanced features, apply results
   b. Evaluate information resources (e.g., literature, databases) for their quality, funding sources, biases
   c. Identify tools to assess patient safety (e.g., medication interactions)
   d. Utilize knowledge-based tools to answer clinical questions at the point of care (e.g., text resources, calculators)
   e. Formulate an answerable clinical question
   f. Determine the costs/charges of medications and tests
   g. Identify deviations from normal (laboratory tests/radiographs/results), and develop a list of causes of the deviation
2. Effectively read and write from the electronic health record for patient care and other clinical activities
   a. Graph, display, and trend vital signs and laboratory values over time
   b. Adopt a uniform method of reviewing a patient record
   c. Create and maintain an accurate problem list
   d. Recognize medical safety issues related to poor chart maintenance
   e. Identify a normal range of results for a specific patient
   f. Access and compare radiographs over time
   g. Identify inaccuracies in the problem list/history/medication list/allergies
   h. Create useable notes
   i. Write orders and prescriptions
   j. List common errors with data entry (e.g., drop-down lists, copy and paste)
3. Use and guide implementation of clinical decision support (CDS)
   a. Recognize different types of CDS
   b. Be able to use different types of CDS
   c. Work with clinical and informatics colleagues to guide CDS use in clinical settings
4. Provide care using population health management approaches
   a. Utilize patient record (data collection and data entry) to assist with disease management
   b. Create reports for populations in different health care delivery systems
   c. Use and apply data in accountable care, care coordination, and the primary care medical home settings
5. Protect patient privacy and security
   a. Use security features of information systems
   b. Adhere to HIPAA privacy and security regulations
   c. Describe and manage ethical issues in privacy and security
6. Use information technology to improve patient safety
   a. Perform a root-cause analysis to uncover patient safety problems
   b. Become familiar with safety issues
   c. Use resources to solve safety issues
7. Engage in quality measurement selection and improvement
   a. Recognize the types and limitations of different types of quality measures
   b. Determine the pros and cons of a quality measure, how to measure it, and how to use it to change care
8. Use health information exchange (HIE) to identify and access patient information across clinical settings
   a. Recognize issues of dispersed patient information across clinical locations
   b. Participate in the use of the HIE to improve clinical care
9. Engage patients to improve their health and care delivery though personal health records and patient portals
   a. Instruct patients in the proper use of a personal health record (PHR)
   b. Write an e-mail to a patient using a patient portal
   c. Demonstrate appropriate written communication with all members of the health care team
   d. Integrate technology into patient education (e.g., decision-making tools, diagrams, patient education)
   e. Educate patients to discern quality of online medical resources (e.g., websites, apps, patient support groups, social media)
   f. Maintain patient engagement while using an EHR (e.g., eye contact, body language)
10. Maintain professionalism through use of information technology tools
    a. Describe and manage ethics of media use (cloud storage issues, texting, cell phones, social media professionalism)
11. Provide clinical care via telemedicine, and refer those for whom it is necessary
    a. Be able to function clinically in telemedicine/telehealth environments
12. Apply personalized/precision medicine
    a. Recognize the growing role of genomics and personalized medicine in care
    b. Identify resources enabling access to actionable information related to precision medicine
13. Participate in practice-based clinical and translational research
    a. Use EHR alerts and other tools to identify patients and populations for offering clinical trial participation
    b. Participate in practice-based research to advance medical knowledge

Competencies for clinical and translational research (Valenta, 2016)

- Utilize informatics-based tools in translational research including: locate relevant informatics tools; select appropriate informatics tools; and use those tools in research for managing and analyzing biomedical and health information
- Describe the essential functions of the major clinical systems (eg, the EHR and its feeder systems, such as radiology and lab) that are relevant to CTS and the challenges to using these data for research
- Describe the essential functions of major research computer systems (eg, clinical trials management systems, biospecimen management systems, research grant and finance management systems, and research services tracking systems) that are relevant to CTS
- Compare and contrast the organizational roles and principal responsibilities essential for access, management, and governance of data related to CTS
- Explain the role of health information technology standards in the interoperability of research, clinical, and administrative information systems and on secondary use of data for CTS
- Identify, retrieve, and manage biomedical and health science knowledge through literature searches using advanced search techniques (MeSH, PubMed, Google Scholar, etc.)
- Describe the essential information generation, management, analysis, transformation, summarization, and visualization methods that apply to CTS data, such as: genomic, proteomic and other "-omics" data; clinical data; imaging data; consumer and patient-reported data; and population-level and environmental exposure data

OHSU

Accomplishments of OHSU informatics education program

- Graduate program
- NIH training grant
- Clinical informatics fellowship
- Use of distance learning
- Medical student education
- Education for other learners

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Biomedical informatics graduate program

- First program was Master of Science, launched in 1996
- Current degree and certificate programs (Hersh, 2007)
  - PhD – since 2003
  - Two master's degrees
    - Master of Science – first program
    - Master of Biomedical Informatics – "professional" master's since 2002
  - Graduate Certificate – since 2001

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OHSU informatics – current delivery

Degree/Certificate Track	PhD	MS	MBI	Grad Cert
Clinical Informatics	On-campus	On-campus On-line	On-campus On-line	On-campus On-line
Bioinformatics & Computational Biology	On-campus	On-campus		

In process of some changes:

- From "tracks" to "majors"
- From MBI to Master of Science Without Thesis
- Name changes to reflect evolution of field
  - Health & Clinical Informatics
  - Bioinformatics & Computational Biomedicine

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OHSU informatics – by the numbers

Degree/Certificate	Total	BCB	CI
Doctor of Philosophy	24	6	18
Master of Biomedical Informatics	206	14	192
Master of Science	88	17	71
Certificate Program	420	0	420
Total	738	37	701

738 degrees and certificates awarded to 666 people since 1998

International collaborations in

- Egypt
- Argentina
- Singapore
- Thailand
- And many international students coming to or accessing courses from OHSU

Where domestic online students live

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Training grant and clinical fellowship – family of fellows

- NIH/National Library of Medicine training grant continually since 1992
  - Currently funds 9 predoc (PhD) and 4 postdoc trainees
  - Renewed in 2017 for 6th five-year cycle
    - Including 2 trainees funded by NIEHS
- ACGME-accredited Clinical Informatics Fellowship since 2015
  - Among first 4 programs launched (Longhurst, 2016)
  - Knowledge learning from graduate courses
  - 5 other fellowship programs using our online courses

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Success also due to use of distance learning

- Growing interest led to launching of first online course in 1999 (Hersh, 2001)
  - BMI 510 – Introduction to Biomedical Informatics
- Next developed credentials
  - Graduate Certificate
    - 8-course subset of master's
  - Master of Biomedical Informatics
    - Professional master's, differing mainly in
    - On-line, with requirement of 2 on-campus short/hybrid courses

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Use of distance learning (cont.)

- Has also enabled repackaging of material in continuing education framework – 10x10 ("ten by ten") course
  - Adaptation of on-line BMI 510
  - Partnership with professional association, AMIA
  - Name derived from goal of educating one physician and nurse in each of 6000 US hospitals by 2010 (Hersh, 2007)
    - Although open to anyone with any background
  - Evaluations showed high satisfaction and, for about 15-20%, pursuit of further education (Feldman, 2008; Williamson, 2011)
  - 1000 completed by 2010; continued interest since, with over 2300 completed to date
  - Translated and revised in Spanish for Latin America (Otero, 2010)

10x10™
Training Next-Generation Informatics Leaders

OHSU

Other educational grants to program

- 2009 – Informatics Training for Global Health training grant by NIH Fogarty International Center in collaboration with Hospital Italiano de Buenos Aires ($1M)
- 2010 –ARRA HITECH Act for workforce and curriculum development ($5.8M)
- 2014 – NIH Big Data to Knowledge (BD2K) Initiative, development of open educational resources ($1M)
- 2015 – Update of ARRA HITECH curriculum ($1M)

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OHSU

Teaching clinical informatics to medical students (Hersh, 2017)

- Based on competencies
- With stated learning objectives
- Delivered by appropriate modality
  - Large group lecture or interactive
  - Small group skills – e.g., EHR, quality measures
  - Clinical informatics pearls (asynchronous 7-15 minute online lecture)
  - Enrichment (optional) – in-depth topics (EHR), clinical informatics careers
- Each with appropriate assessment

Education for other learners

- Clinical and translational researchers
  - Courses in Human Investigations Program (HIP)
  - Mapping of grant-funded curricular modules to competencies
    - https://dmice.ohsu.edu/bd2k/mapping.html
- Basic science graduate students
  - Participating in Creative IDEAS
- Undergraduates at Portland State University
  - Long-standing 3+2 articulation with Computer Science
  - Newer developments with School of Public Health
    - Undergraduate course in health informatics this year
    - Undergraduate degree?

Lessons learned

- Students
- Technology and modalities
- Program and support

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Students

- Evolution of an academic field to a professional one
  - Parallels changes in work, e.g., home-grown to commercial EHRs
- First-careers vs. career-changers
  - Entry by many into field, especially from health professions, after initial training
- Virtual community
  - Emerged among students leading to professional connections, common interests, and even (in two instances) marriage

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Students (cont.)

- Most students (at least those in our program) prefer courses online
  - Even many who live locally
  - Now difficult to fill classrooms
- Almost all learning can occur remotely
  - All distance learning does not need to be online, e.g., internships and practicums

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Technology and modalities

- In most fields, technology replicates classroom
  - Lectures
  - Interaction
  - Assessment
- Technology has improved
  - As has OHSU support of it

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Lectures

- Have used voice-over-Powerpoint for many years
- Through successive tools
  - Real Media
  - Adobe Presenter
  - Articulate Presenter
- Adds a somewhat “active learning” approach to lectures
  - Chunked into smaller segments
  - Can start and stop, re-listen
  - Can provide interaction

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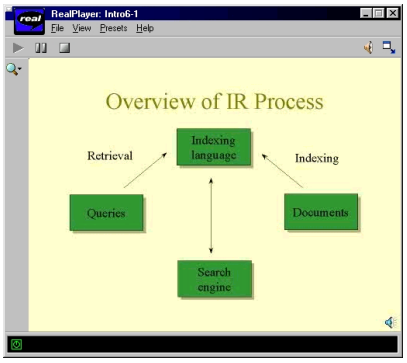
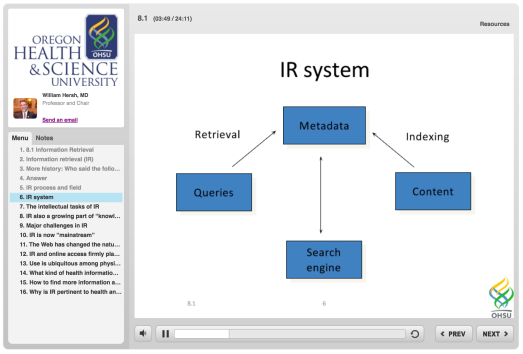
We’ve come a long way?





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Articulate Presenter – pros and cons

Pro

- Best tool available
- Works as plug-in to Windows Powerpoint
- Allows narration one slide at a time
- Outputs in standard formats
  - Flash and HTML 5
  - MP3 audio
  - Mobile

Con

- Expensive
- No native Mac version (but runs under Windows virtual machines)

Interaction

- Threaded discussion forums
  - Moderation of discussion essential
- Real-time video
  - Transitioning from Sakai to Cisco Meeting
- Virtual projects
  - Builds team skills but challenges due to other life commitments and time zone differences

Assessment

- Just about anything that can done in person can be done on online
- Homework assignments – I've come to love multiple-choice questions
- High-stakes exams – virtual proctoring

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Program

- Can't ignore business aspects
- Sakai and its support has been critical
- Response to students also essential
  - Rapid response to problems and inquiries important, even if only acknowledgement with follow-up
  - Program policy is for faculty to respond to all student communications in their courses within 2 business days

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Other lessons

- Living the asynchronous life
- Human connection to learners still essential
- Our success has spawned competitors
- Facing competition from new models of learning, e.g., MOOCS

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Conclusions

- Faculty and staff of DMICE have provided innovative education and training leading to career success of informatics professionals in diverse jobs and settings
- Of increasing importance is dissemination of knowledge and skills in informatics to other health professionals and the larger public
- Technology is important but understanding of competencies, student needs, and program management is much more critical
- Have also achieved scholarship and grant funding

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