

***Tools and techniques for engaging health science students with
interactive and multimedia-rich on-line learning***

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Abstract

Changes in modern healthcare have transformed student training in the health sciences. Student now often more spend time off-campus in community-based care centers necessitating ready-access to instructional resources, medical information and communication tools. The Ohio State University College of Medicine & Public Health continues its tradition of curricular innovation by engaging its students with creative technology-based learning resources. A number of educational projects are currently underway that take advantage of innovative multimedia development and deployment strategies. Samples from the College's technology portfolio will be presented illustrating the diversity of tools and deployment strategies being employed in a variety of disciplines.

A Tradition of Innovation

The College of Medicine & Public Health at the Ohio State University was one among a handful of pioneering institutions to introduce the use of computers in training future physicians. Computer-assisted instruction (CAI) was an integral part of the College's curricular innovation introduced during the mid-1960s. Termed the *Pilot Medical School*, this novel approach to pre-clinical training allowed students to complete the first two years of their training in an independent-study format and made extensive use of computer-based tutorials and resources. By the early 1970s the College had assembled a technical staff to assist faculty in the development of computer-based learning modules. By the 1980's College-generated CAI content was being used by a significant number of United States medical schools helping to establish the College of Medicine as a national leader in computer-based medical education. However, with the emergence of the more affordable personal computer and authoring tools that were easier to use, the need for a centralized College support staff greatly diminished. As a result during the late 1980s interested faculty designed and authored their own computer-based applications in the absence of a centralized support staff. Many of these faculty-initiated learning, technology innovations, were subsequently integrated into the curriculum.

More recently, changes in modern health care delivery, technology and the evolving learning environment are transforming medical student training. Curricular revisions are now underway in the College with the goal of promoting active student learning, enhancing the use of technology, immersing students to a greater extent in community-based medicine and encouraging the development of lifelong learning skills. As a result Ohio State medical students will be mentored to a greater extent in community-based care settings throughout the state of Ohio. The physical separateness from the traditional, on-campus learning environment challenges students to train more independently and necessitates ready-access for students to instructional materials, resources, and communication tools. To facilitate convenient access to such resources and encourage the development of lifelong learning skill, the College has undertaken several technology-driven educational initiatives.

Academic Medicine Web Portal

To provide medical students with access to online educational resources, timely news and information, and communication tools, an academic medicine portal is now in place for the College of Medicine & Public Health. ***Academic.Med*** serves as a primary web portal providing medical students with access to online course materials, academic calendars, course contacts, clerkship scheduling, interactive courseware, web-accessible email among other resources. The site is tightly coupled with the functionality of the main College site.

[See <http://academic.med.ohio-state.edu>]

Online Courses & Educational Resources Development

Web Course Tools™ (WebCT) is a learning management system that permits the creation of sophisticated web-based educational environments by individuals with limited technical skills. The College is currently hosting over 125 WebCT-based instructional resources. While many of these courses are still underdevelopment, a number are currently in full production being used by nearly 4500 students in the OSU health sciences in the following sub-disciplines:

- Anatomy
- Allied Medicine
- Circulation Technology
- Dentistry
- Geriatrics/Gerontology
- Health Information Mngmt Systems
- Health Services Management & Policy
- Histology
- Medical Technology
- Medical Dietetics
- Neuroscience
- Occupational Therapy
- Optometry
- Ophthalmology
- Pediatrics
- Pharmacology
- Physical Therapy
- Physiology
- Public Health
- Radiologic Technology

Faculty in the health sciences at Ohio State are using the suite of tools bundled in WebCT to: provide students with access to lecture and reading materials, engage students in synchronous and asynchronous discussions, allow students to test their exam readiness using WebCT's quiz and survey tools, among other activities.

[See <http://classroom.med.ohio-state.edu>]

Computer-based Testing in Medical Education

In June of 1999 the US Federation of State Medical Boards, Inc. and the National Board of Medical Examiners undertook the conversion of the United States Medical Licensing Examinations (USMLE™) from paper to computer-delivered format. To prepare Ohio State medical students to this new testing paradigm,

the College is piloting the development of online testing and student assessment capabilities in the Independent Study Program. Having just complete year one of a feasibility study, the College is presently converting paper-based exams in the ISP program using the WebCT-delivery model.

An Interactive Web-based Primer for Teaching Physical Examination Skills

While some disciplines lend themselves to the tools and techniques of the modern digital classroom (*e.g.*, anatomy, embryology, pathology, *etc.*), other fields challenge educators and developers in their attempt to innovate. One core set of mastery skills that have proven challenging for medical educators and developers to simulate in an engaging Web-accessible fashion is the fundamental techniques of the physical examination.

Teaching physical examination skills can be challenging when faced with coordinating the activities of large and diverse groups of medical students and physician teachers. Two hundred and ten medical students matriculate each year at the Ohio State University College of Medicine & Public Health where they select experiences and approaches that fit their individual learning styles and career goals. During their first two years where they select one of the three learning pathways – Lecture/Discussion, Problem-Based Learning, or Independent Study – students are introduced to clinical medicine through didactic and student-preceptor experiences. Ensuring that this large and diverse group of students is exposed to a common set of normal and abnormal physical exam findings and hand-on techniques has always been logistically challenging.

To help overcome these challenges we have developed an interactive, web-based primer to introduce medical students to the fundamental principles, techniques and findings of the physical examination. Focusing on seven primary content areas – head and neck, pulmonary, cardiovascular, abdominal, musculo-skeletal, neurological, and urogenital – we have integrated Macromedia Flash, Cold Fusion and streaming technologies to create a resource that will supplement the traditional learning strategies in the physical exam course. Examples will be shown to illustrate the types of development and deployment strategies employed to assemble this multimedia-rich, highly-modular site. Specifically, we will show how Flash was used to mimic taking a blood pressure, simulating a pulmonary assessment, performing a fundoscopic exam, among other techniques. In addition examples will be shown illustrating how synchronized multimedia integration language (SMIL) was used to enhance short digital video demonstrations of common exam techniques. Support for this project comes from the U.S. DHHS Bureau of Health Professions, HRSA (1-D05-PE-80150), the Department of Family Medicine, and the College of Medicine & Public Health at The Ohio State University.

[See <http://medicine.osu.edu/exam>]

Streaming Multimedia Resources

The College recently undertook the development of a virtual tour designed as a recruiting tool for medical student and resident applicants. The tour contains six high-quality, digital videos that provide on-line visitors with an overview of the

College, its student and curriculum in addition to the programs of study in the Medical Center. In addition, development of the capacity to deliver multimedia resources that demonstrate unique clinical applications and therapeutic techniques in electronic form is currently underway. Time and logistics often limit student access to unique clinical experiences. It is envisaged that once in place many of these digital resources will be used for online teaching, evaluation, and assessment.

[See <http://medicine.osu.edu/admissions/tour.cfm>]

Three - Dimensional Computer Modeling and Simulations

Design of interactive, digital learning objects and models are also underway. Success in medicine demands that students master key, spatial relationships. Interactive computer representations are slowly replacing the plastic anatomical and molecular 3-D models that students used in years past. Such computer-based presentations offer unique views of structures and relationships that often cannot be appreciated by physical models due to size and other physical limitations. In addition, the on-demand delivery of computer-based models gives all students the opportunity to explore such key concepts. Several projects are underway by faculty to use QuickTime Virtual Reality™ (QTVR), Virtual Reality Modeling Language (VRML) and other tools to construct models for teaching important anatomical relationships, and human embryonic development.

For example, a project is currently in development that will provide students with an interactive web-based resource for studying the spatial organization of the human head. Briefly, a three-dimensional interface generated using virtual reality modeling language (VRML) will allow students to select views of the human head from three planes of anatomical sectioning (*i.e.*, sagittal, coronal and transverse) in order to test their understanding of key spatial features and relationships.

[See <http://medicine.osu.edu/2md/projects>]

Supporting Educational Technology Development

Local technical support for faculty is critical to move technology-enhanced learning and research forward. As across university campuses, faculty development of technology-based learning resources in the health sciences grew from grassroots efforts. However, the ever-increasing speed at which technology advances began to discourage such faculty-initiated developments in the mid 1990s. Faculty, once proficient with the development tools began finding it more and more difficult to keep up with the ever-advancing technology. Alleviating the need of requiring faculty to keep up with the ever-increasing current of technological advances will allow them to focus on content development and student learning issues. The common content, similar pedagogical challenges and changing learning environment spurred the College of Medicine & Public Health, School of Allied Medical Professions, School of Public Health and the College of Optometry, to discuss a collaborative, inter-college approach to meeting the needs of our students and technology-challenged faculty. These

discussions led to the collaborative establishment of an applications development group that adopted the moniker of **2md - Medical Multimedia Design**.

2md is an interdisciplinary team of developers in the College of Medicine and Public Health charged with designing, developing and implementing innovative web-based applications that support, enhance and extend the educational missions in the participating health science units, which collectively serve nearly 1700 students at the undergraduate, graduate and professional levels. The logistical and technical challenges presented by such a collaborative approach between colleges was originally proposed as a test model for other units considering ways of meeting their technology-enhanced learning needs. To date this collaborative arrangement has helped achieve economies of scale in a field where undertaking new initiatives are most often hampered by startup costs. **2md** provides consultation and production support to health science faculty engaged in technology-based instructional development by (i) assisting and advising faculty on adapting course materials for Web delivery and (ii) developing innovative web-based applications using advanced and hybrid software technologies [e.g., streaming media technologies (*Real Media, QuickTime, SMIL*); interactive multimedia (*Flash, JavaScript, dynamic HTML*) and; database-driven content delivery (*Cold Fusion/SQL*)].

[See <http://medicine.osu.edu/2md>]