

A new teaching environment for healthcare providers

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The conference's scientific program recognizes the shift from traditional biomedical perspective in the Western Hemisphere of considering patients as objects and concentrating on the "sick parts" of the human body to a modern concept of disease as multifaceted and a focus on health promoting processes. Just as the design of healthcare environments must change to facilitate the conceptual shift, the design for training physicians and other healthcare providers must change. With the increase of ambulatory care reducing availability of patients for long-term study, other means of training medical students must be developed. The objectives of this paper are two-fold: one, to discuss the new healthcare environments in which the physician-in-training sees patients; and two, to describe curriculum innovation that addresses the change in the clinical environment.

In 1996, the Institute for Education and Research was established as a joint venture of Harvard Medical School, Beth Israel Hospital and Mount Auburn Hospital. Renamed in 1999, the Carl J. Shapiro Institute for Education and Research at Harvard Medical School and Beth Israel Deaconess Medical Center has expanded both its original mission and its space. Facilities include a teaching laboratory of unique "smart" modules where students have access to their own computers and to the instructor's computer screen; a "smart" classroom, linked electronically to the Medical School and to clinical areas; Fellows' workspace; and a media studio where electronic curriculum modules are produced.

These facilities are the laboratory for an electronic curriculum that centers on "the virtual patient" as a mechanism to train medical

students in taking histories, making diagnoses and prescribing therapies that recognize the "concept of disease as multifaceted" and focus on health promotion.

The results are an environment where students and faculty learn through interaction, "virtual" learning supplements an increasingly fast-paced care-giving setting, and new academic curricula are developed to enhance quality of medical care and patient outcomes.

The objectives of the paper as originally stated were:

one, to discuss the new healthcare environments in which the physician-in-training sees patients; and two, to describe curriculum innovation that addresses the change in the clinical environment.

The changes in the clinical environment drive both the changes in the physical environment and the changes in curriculum to prepare the



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physician-in-training for the new clinical environment. This paper will attempt to describe these forces and show their interrelationship.

Context: A brief history of medical education in the United States

Colonial America: Physicians-in-training apprentice to physicians or study abroad in London, Paris, Edinburgh.

- 1765 University of Pennsylvania establishes school of medicine.
- 1766 King's College (now Columbia University) becomes first institution in colonial America to confer degree of doctor of medicine.
- 1782 Harvard Medical School established. Medical education consists of one or two semesters of formal lectures and several years of apprenticeship. No teaching hospitals exist.

Nineteenth Century: Graduate medical degree conferred in United States.

- 1809 College of Physicians and Surgeons is chartered as a division of Columbia University
- 1846 Introduction of ether as anesthesia for surgery at the Massachusetts General Hospital.
- 1847 American Medical Association (AMA) establishes standards for preliminary medical education and for the degree of M.D.
- 1889 Johns Hopkins Hospital establishes Internal Medicine residency.
- 1893 Johns Hopkins Medical School becomes the first medical school to require all applicants to have a college degree, and the first to offer training in an affiliated teaching hospital.¹

Twentieth Century: Standards for teaching and development of new curricula.

- 1906-7 AMA Council on Medical Education and Association of American Medical Colleges (AAMC) establish standards for course content, teacher qualifications, practitioner licensing. AMA inspects 160 medical schools and classifies them into three groups: A = acceptable; B = doubtful; C = unacceptable.
- 1910 Publication of *Medical Education in the United States and Canada*; Abraham Flexner, American education reformer, writes critically of low standards and facilities of proprietary medical schools.
- 1914 AMA Council on Medical Education sets standards for hospital internship programs and publishes first list of approved hospitals offering programs.
- 1923 AMA adopts new standards for medical specialty training.
- 1985 Harvard Medical School inaugurates the New Pathway curriculum, a problem-solving case-method approach to learning, offering students the opportunity to come in contact with patient cases early in their studies.
- 1996 Institute for Education and Research, a joint venture of Harvard Medical School and Beth Israel Hospital (now Beth Israel Deaconess Medical Center), is established in 1996 as a nonprofit organization designed to address the impact of fundamental changes in healthcare on the future quality of medical education and teaching.

¹ (includes section from Colonial America to this point) "Medical Education," Microsoft Encarta Online Encyclopedia 2000, <http://encarta.msn.com> c 1997-2000 Microsoft Corporation



Changes in medical education generated by changes in medical practice

The two major forces at the end of the twentieth century bringing about changes in medical education were: one, the shift of patient care from the inpatient to the outpatient setting; and two, the impact of information technology on the delivery of patient care and on education. The Institute for Education and Research was established to address both of these issues.

As the delivery of patient care moved from the inpatient to the outpatient setting, fewer patients were confined to a bed for several days or weeks, available to the medical student according to the schedule of the academic day. Increasingly, for the same diagnosis or treatment that previously required a hospital stay, the patient comes to an outpatient building, remaining only hours or minutes, a pace not accommodating to the student's academic schedule. Other ways to teach medical students had to be developed to supplement the bedside training.

At the same time as the focus shifted from inpatient to outpatient care, the transfer of information was being revolutionized – in place, time, capacity to analyze large amounts of data and ability to simulate. In previous decades, use of medication in military emergency translated later to civilian use. At the end of the twentieth century, the development of the internet, initially developed for *military crisis conditions*, subsequently found application in all fields of knowledge and business. During the Vietnam era, remote surgery techniques were developed so that a surgeon could operate on a patient by digital image, remote from the battlefield. These techniques found application in medical education at teaching hospitals. Observation galleries overlooking operating rooms were displaced by a remote classroom where groups of students observe surgery in “real-time” or in their own time. Distance learning at all levels is supplanting or augmenting the need to be “on site” – whether in a classroom with a teacher or at the patient's bedside.

The Institute for Education and Research: A testing ground for new methods of teaching and learning



The establishment of the Institute for Education and Research was grounded in changes in healthcare delivery and in information technology.

Mission Statement

The mission of the Carl J. Shapiro Institute for Education and Research at Harvard Medical School and Beth Israel Deaconess Medical Center is to develop new models for the organization of teaching and research at academic medical centers. By promoting innovation, and providing intellectual leadership and state-of-the-art facilities for students, trainees and faculty, the Institute will devise and share responses to the evolving challenges facing academic med-

icine. Through fostering medical education and research, we will train clinical, education and research leaders whose effects will improve the quality of medical care and health in the nation and the world.²

The Executive Director describes the Institute as follows:

Beth Israel Deaconess Medical Center and its earlier component institutions, Beth Israel Hospital and Deaconess Hospital, have long traditions of excellence in a variety of spheres. Besides providing outstanding patient care from its world-class physicians and renowned nursing service, Beth Israel Deaconess Medical Center represents the best in academic medicine – as an affiliate of Harvard Medical School and a leader in medical education and cutting-edge medical research.

The Carl J. Shapiro Institute for Education and Research at Harvard Medical School and Beth Israel Deaconess Medical Center, established in 1996 as an independent non-profit organization, is a result of the visionary thinking of Drs. Daniel Tosteson (then Dean of Harvard Medical School) and Mitchell T. Rabkin (then CEO of Beth Israel Hospital) and the philanthropic support of Mr. Carl J. Shapiro. The goals of the Institute are several:

- Supporting the academic mission of Harvard Medical School and Beth Israel Deaconess Medical Center in their efforts to train the next generation of physicians;
- Furthering the progress of innovative medical research, not only basic medical research but also the translation of research at the laboratory bench to clinical applicability at the patient's bedside, i.e., "bench to bedside" research;
- Developing innovative methodology, curricula, and programs for training the next generation of physicians and medical educa-

tors, with applicability that extends to other medical schools and academic medical centers throughout the country and around the world.³

The Institute for Education and Research is located at the lobby-level of the Medical Center's ambulatory care building. It is the first training ground in the United States for medical school students rotating through the ambulatory care environment with study space available twenty-four hours a day. The Institute designed by Rothman Partners as the "home base" for Harvard medical students doing core clerkships and clinical electives at Beth Israel Deaconess Medical Center, includes:

- A Common Room equipped with computer workstations for individual and group learning, featuring access to the internet and the Medical Center's clinical information and e-mail system, and multimedia education programs used in the core clerkships, including Virtual Patient cases and the "Aberrant Air" radiology teaching program. Each of the workstations is connected to a laser printer. The Common Room also houses lockers for use by students during core rotations and a lounge area;
- A fax machine for local faxing and with capabilities for long-distance faxing with a personal credit card;
- A kitchen and dining area equipped with microwave, refrigerator, and sink;
- A conference room for small-group teaching sessions, and a classroom equipped with full audiovisual capabilities;
- A state-of-the-art multimedia production facility to support the development of multimedia educational programs.
- A Fellows Room with workstations for Fellows of the Institute, doing post-graduate research or continuing medical education.

² Mission Statement, Institute for Education and Research at Harvard Medical School and Beth Israel Deaconess Medical Center

³ Steven Weinberger MD, Professor of Medicine, Harvard Medical School; Executive Director, Institute for Education and Research





Floor Plan

Legend

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|--------------------|------------------------|------------|
| 1. Entry | 4. Fellows Room | 7. Lounge |
| 2. Reception | 5. Classroom | 8. Offices |
| 3. Conference Room | 6. Computer Laboratory | |



Students enrolled in courses at Beth Israel Deaconess Medical Center are given 24-hour-a-day access to the Institute.

The plan organizes the program into two zones linked by common circulation: one zone is dedicated to medical students and fellows and is comprised of a conference room, classroom for 30, a computer laboratory and lounge; the other zone accommodates offices for faculty

and researchers. The computer laboratory is designed as a study/common room available to students around the clock. It has state-of-the-art computer workstations that foster collaboration among groups of students and provides a technical resource to create case-method management program.

Virtual Patient Project

The technological resource will be used to execute the Virtual Patient Project, a series of multimedia teaching cases that allow medical students and post-graduate trainees to learn about common illnesses with which all doctors, regardless of specialty, should be familiar. These virtual patient cases enhance the direct patient experiences of medical students and post-graduate trainees during clinical training. A complete library of cases will cover the spectrum of common illnesses that should be experienced by all undergraduate medical students. Sixteen Virtual Patient cases are currently in various stages of development. In July 1997, the Shapiro Institute received a generous three-year grant of \$1.6 million from the Josiah Macy, Jr. Foundation to develop a series of fifteen Virtual Patient cases. An education grant from Merck & Co, Inc. funds the development of the sixteenth case, a patient with osteoporosis.

Virtual Patient cases, delivered on one or two CD-ROMs or possibly in the future on the internet, provide opportunities for students they would not otherwise have – to encounter the patient *de novo*, before a diagnosis has been made; to develop a differential diagnosis; to make decisions about diagnostic testing, therapies and management; to follow the patient over time; to learn about the natural history of the disease; and to move with the patient as care is delivered by different members of the caregiving and diagnostic team.

Computer-based multimedia technology, utilizing audio, digital full-motion video, high-resolution images, animation, text and graphics, enables the Institute to achieve these important objectives of medical training and to advance an emphasis on the interdisciplinary nature of caring for the whole patient. By convening a range of specialists in virtual conference for the case, each Virtual Patient allows a student to consult with experts who seldom would be available and together at one place in real time. This interdisciplinary focus also brings to the forefront aspects of medicine that a student rarely encounters. For example, experts will help

the student choose the right diagnostic tests to order. In this way, medical professionals who are usually involved “behind the scenes” with patient care will be able to contribute to a student’s education. Students will also have the opportunity to review the pathophysiology and genetics underlying the Virtual Patient’s disease, thereby building on the knowledge base developed during the first two years of medical school and applying that knowledge to the diagnosis and management of the disease.

Incorporating facilities for teaching into the healthcare environment

The Carl J. Shapiro Clinical Center

As the site of the Institute for Education and Research and location for ambulatory care teaching at Harvard Medical School, the Clinical Center was designed by Rothman Partners to incorporate many features for teaching including:

- Exam rooms of 125 sf (11.6 sm), adequately sized for patient, family member or interpreter, caregiver, and caregiver-in-training.





- Audio-visual capability in selected exam rooms where students can be videotaped in their interaction with patients.
- Closed circuit television in ambulatory operating rooms, enabling distance learning in conference areas and classrooms within the Medical Center and at the Medical School.
- Conference/teaching space within each clinical suite, as well as in the Institute and in a central conference center within the ambulatory care building.
- A Learning Center where patients and families have access to healthcare information both in print and on-line.

Northeastern University Behrakis College of Health Sciences

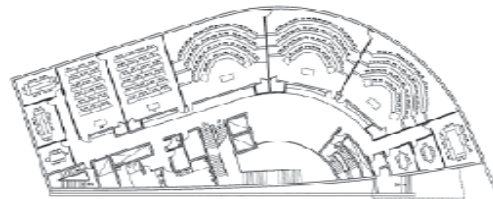
Rothman Partners and Kyu Sung Woo Architects are associated architects for the program and design of the new 100,000 sq. ft. Northeastern University Behrakis College of Health Sciences. The new College encompasses the College of Nursing and the Bouve School of Allied Health Sciences which includes physical therapy and related technologies. The new College has been organized to enhance multi-disciplinary learning. Graduates are expected to shift careers, during life-long professional careers in the healthcare industry.

Multi-disciplinary learning promotes adaptability to respond as healthcare providers as medicine and dentistry are revolutionized. As the teaching and non-teaching medical institu-

tions in the United States have less time to educate those in the allied health professions, graduates must come to their jobs ready to act as qualified professionals. The College of Health Sciences includes simulated environments that accelerate job readiness.

Special elements of the Behrakis College of Health Sciences include:

- A teaching computer center for fifty students, learning in clusters of ten people each, patterned after the Institute for Education and Research.
- An autopsy laboratory with computer software mounted at the autopsy tables to provide images of the live human body to guide learning during procedures.
- A clinic environment with viewing rooms between simulated patient examination rooms for studying interviewing technique and patient processing.
- A classroom surrounded by intensive care rooms that simulate the critical care environment. The quaternary hospital will be a hospital occupied by intensive care level beds, requiring staff educated for a high level of acuity.
- Simulated technical areas for stress testing



Floor 4.



Floor 5.



- and cardio-pulmonary function testing.
- Student support space for faculty counseling in academic, cooperative education and career counseling. Northeastern University has always had a strong cooperative education program in which students work in the healthcare environment, taking a semester off from the classroom in each academic year.

University of Michigan Dental School

Rothman Partners, with Paulien Associates educational consultants, developed a Master Plan for the University of Michigan Dental School. The goal of the University of Michigan Dental School has been to execute multi-disciplinary learning, accelerate utilization within the clinical setting, and increase dental research, particularly

in tissue research. The school teaches dentists and dental hygienists within the same clinics. It introduces first and second year dental students into the clinics earlier, learning clinical techniques from dental hygienists and more advanced dental students. By the third year, the students are so familiar with clinical work that their utilization within the practicum is advanced almost a year over prior classes. Seniors are better prepared to become involved in the post-graduate specialties and determine their interest in those specialties.

Computers are now attached to the dental chairs and used actively as part of the learning process. Students are able to schedule patient appointments, review their daily schedules, and bring up videos related to technique while they are performing a procedure from the dental chair. With improved radiation protection, dental chairs include x-ray equipment. Microscopes are attached to the chair's light post for education in endodontic procedures. The net result is a fully out-fitted chair that requires more space at each student operatory. To accommodate larger student operatories, utilization is expected to increase, based on academic and equipment improvements cited.

