Editorial Comments

Education and Informatics:
It's Time to Join Forces

This issue of *JAMIA* is intended to sound a clarion call, alerting us to the importance of education as an area for innovation through informatics. The ties between informatics and education are natural, because informatics is all about how we access and use information and thus how we learn. Nonetheless, the education and informatics communities have remained largely separate, forsaking many opportunities to benefit through collaboration. Much of the work on application of informatics to education has involved isolated supplementation of traditional instruction with computer-based resources. The advent of network-based information resources, together with affordable multimedia capacity, position the education and informatics communities to come together. Together, enabled by informatics, we can develop new strategies for how we learn, where we learn, and when we learn.

At least three specific arguments support the union we advocate:

First and foremost, education in the health professions is completely intertwined with practice. Applications of information technology to support practice are de facto educational and should be designed with that function in mind. The psychology that underlies decision support is in many ways the psychology of learning. It is important to remember that the educational process begins with matriculation into professional school (some would say that it begins even before professional school) and ends with retirement (some would say that it continues even beyond retirement). Throughout their careers, practitioners continue to learn. As information technology increasingly supports professional practice, it necessarily supports education as well.

Second, the contemporary challenges facing education in the health professions, and the potential of information technology to help address these challenges, raise questions that creative members of the informatics community should find fundamentally inter-esting. Just to name a few: How do we provide more authentic assessment of students' clinical knowledge, judgment, and skills? How do we promote understanding of basic science concepts and principles that have perplexed students for years? How do we make the resources of the library available to students who increasingly are studying in community practices remote from the medical center? How do we move the emphasis in education from memorization of disparate facts to understanding of principles, particularly when the "facts" will be increasingly available in electronic form?

Third, today's students and residents are tomorrow's practitioners. We must prepare them for the practice environment that they will be entering, a future environment that will be far better endowed with information resources than even the most advanced clinical settings are today. This imperative challenges educational institutions to be ahead of the curve, to provide their trainees with exposure to the kinds of information systems that are not universally online now, but will be as these trainees mature into practice.

For the proposed union to have maximum benefit, a broad view of what constitutes educational work in informatics must be taken. The full range includes:

1. *Domain-specific "courseware."* These applications are designed to introduce learners to, or deepen their understanding of, a particular domain of knowledge or skills. This category can be viewed as an expansion of traditional computer-based instruction, recognizing that the multimedia capabilities of relatively inexpensive computers allow this courseware to transcend purely didactic presentations. The best courseware can propel learners into vivid simulations, allowing them to practice patient workups or procedures, or to experience realistic animated representations of phenomena at the molecular level.

2. *Information resources for learners.* These applications place the world's biomedical information at the fin-

gertips of learners for educational purposes. They run the gamut from medical dictionaries; to access to MEDLINE and all the documents it lists; to fact, text, and image bases about a range of biomedical entities, such as drugs, microorganisms, human anatomic structures, and disease processes. As education decentralizes into community settings, access to this full range of information sources becomes a critical part of any educational program.

3. *Tools to support administration of educational programs.* Those who run educational programs are managers of a complex system. To perform their jobs well—to make decisions in the best interests of their diverse and distributed clientele—these managers need ready access to accurate information about courses and parts of courses, educational settings and facilities, curricular policies and procedures, the faculty, and the activities of students themselves. Well-designed information systems can provide this needed access and thus improve education wherever they are applied.

4. *Applications for testing and assessment.* Information technology has the potential to revolutionize how we determine the proficiency of students and practitioners. These applications go beyond the relatively mundane item banks that have for years facilitated the creation and scoring of examinations. Newer techniques such as computer adaptive testing, in which questions are selected dynamically as an examinee progresses through a test, are becoming widely used. And for the health professions, sophisticated applications of informatics promises a new generation of "authentic-assessment" exercises, which challenge students with high-fidelity simulations of problems that they must be able to solve as practitioners.

Each of the four articles in the Focus on Education section of this issue of *JAMIA* addresses at least one of these application areas. The work by Miller and Wolf focuses on how to establish an environment that supports the use of domain-specific courseware and describes some of the courseware in routine use at the University of Michigan. Establishing this kind of environment is crucial to the successful use of courseware because these programs no longer need to be locally custom-authored to address every need that arises. The key, as the authors point out, is to have in place at the institutions a mechanism whereby excellent existing courseware can be identified, integrated

meaningfully into the curriculum, and made routinely available to faculty and students.

The work by Spitzer and colleagues describes the process of generating an information resource of enormous interest and almost universal applicability. It is presumptuous for education to lay sole epistemological claim to the Visible Human Project, and indeed, no such claim is being filed. Nonetheless, the imaginations of educators worldwide have been stimulated in almost unprecedented ways by this project and by the potential it creates.

Kanter's article breaks new ground by addressing in a sophisticated way how a rigorous approach to information-system design can empower managers of medical curricula. Although every element of what the design makes possible is not yet in place at the University of Pittsburgh, this design is probably the most comprehensive in existence, and the system in place has already progressed considerably toward realizing the potential of this approach.

Finally, the article by Stevens and Lopo addresses some fundamental issues that arise when one attempts to employ information technology for assessment. Constructing an examination based on clinical case simulations is relatively straightforward compared with the challenge of using the data generated by such an exercise to generate a reliable and valid score. Among the criteria for any scoring system to be valid, experts must outperform novices. Stevens and Lopo's article explores these issues for a scoring system based on neural-network technology.

These intentionally diverse articles illustrate just a fraction of the ways in which education can be enhanced by information technology. We hope that they help to illustrate how creative work motivated by educational needs can lead to interesting projects that enhance the field of informatics overall. *JAMIA* and the SCAMC proceedings need more articles in the spirit of the four excellent works found here.

CHARLES P. FRIEDMAN, PHD,
PARVATI DEV, PHD

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