Med Educ Online [serial online] 2006;11.
Available from http://www.med-ed-online.org

The Doctor's New Black Bag: Instructional Technology and the Tools of the 21st Century Physician

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Keywords: Educational technology, interdisciplinary competency, problem-based learning

The call for interdisciplinary training

The convergence of medicine, technology, politics, and culture has increasingly brought into focus the need for new thought processes in medical education.[1] Without philosophical and methodological advances, students will struggle to meet the challenges of modern practice. Future physicians must be able to understand, to interact, and to collaborate with colleagues from a variety of disciplines. This interaction requires partnerships among experts that integrate process, content, and thought with the goal of producing novel solutions to complex problems.

Over the past decade, a natural evolution of academic medicine and biomedical research has led to an unprecedented focus on interdisciplinary collaboration.[2-4] Despite this seismic shift in approach, medical education has remained behind the curve. Students are not trained to be comfortable and capable in interdisciplinary settings. We see this as an opportunity to fundamentally change the way that medical students make decisions and think about mechanisms and treatments of disease. The emerging proof of concept is that medical school curricula should provide the necessary skills required for students to be confident in interdisciplinary learning, to lead teams, and to embody professionalism and values of ethics in patient care.

The current paradigm of case-based, student-centered, and problem-based learning (PBL) was designed to develop students' abilities to communicate, to problem-solve, and to become "lifelong learners."[5-7] Despite the ability of PBL to foster discussion, it has not led to an interdisciplinary mindset, which requires integrated relationships between students and faculty from a variety of disciplines. While the case-based method of instruction has become well-established in higher education curricula, by itself it does not provide the medical student with the sense of urgency and patient-centered decision making that would be required were the student faced with a real patient in real time. The caregiver does not have the luxury of assessing the entire clinical scenario at one time, but must work with the available facts at presentation and then begin the process of assembling an algorithm of approach. The student's thought process must be sufficiently well developed to go beyond what one already knows in order to reach out for the requisite information. It is at this point that interpersonal and interdisciplinary skills must be either present or rapidly developed if other members of the team are to contribute their expertise.

The challenge of interdisciplinary technology

The term interdisciplinary suggests the integration of new ideas, methodologies, strategies, and clinical constructs from different specialties or professions. This clearly creates a significant logistical challenge. Fortunately, new instructional technologies can be utilized to enable the development of interdisciplinary thought processes in medical education, facilitating a new mindset in future physicians.[8,9]

Instructional technology alone can never provide a substitute for the classic teacher-student interaction. However, it can provide a foundation of medical knowledge that will enormously facilitate and enrich the learning process by forcing students to rapidly integrate a real-time stream of data into clinical practice, ultimately enhancing patient care. While utilization of online curricula (http://www.medicine.manchester.ac.uk/staffdev/newsletters/winter2005.pdf) and web-based learning tools (http://mycourses.med.harvard.edu/ResCourses/MyCourses/TutorialUserGuide.pdf) has undoubtedly changed the face of the practice of science,[10-14] medical schools are now faced with the challenge of restructuring preclinical medical education. In this regard, assessment of instructional technologies must also include metrics to measure the process, rather than only the outcome of learning. Development of new high-resolution assessment strategies should be explored based on methods that have been established for characterizing the learning process, such as transfer case,[15,16] key-feature,[17] and script concordance test.[18,19]

Implementation of instructional technology

The guiding principle of medical instructional technology should be enhancing the process of learning. To this point, we developed a user-defined, interactive case-based online network (ICON, http://icon.hms.harvard.edu/) in the teaching of the neurosciences to facilitate the medical student's teamwork skills, to enhance the integration of information, and to encourage the active participation of faculty in the student's learning.[20] Cases progress "live" in real-time, linking discussion and content that permits students to interact with each other and an interdisciplinary group of experienced faculties who assume the roles of clinician, consultant, and virtual patient in difficult neurological cases. In so doing, we have eliminated the traditional paper case.

As the patient's situation unfolds in much the same way that a real patient would present to a physician, students and the case characters communicate via online learning modules, electronic pagers, and instant messaging, facilitating both asynchronous and synchronous interactions. Students are responsible for the application of the science, guiding the patient's care, requesting consults, coordinating the medical team's activities, and determining the course of action. The educational effectiveness of this use of instructional technology in the curriculum identified several endpoints: urgency in learning associated with real-time information transfer that does not exist in current PBL, even though the learning process is still case-based; increased accountability to the team in the care of the virtual patient and in understanding multiple developments in their patient's disease; establishment of longitudinal relationships among students with faculty and specialists from different disciplines.[20] Additionally, patterns of interactivity among users revealed that each participant contributed equally between generating new discussion topics and contribution to ideas of colleagues, suggesting that the stimulant nature of this educational technology is equally conducive to the dissemination of new thinking as well as collaborations among faculties and consultants across specialties. The net effect is a patient-centered, interdisciplinary learning environment that effectively integrates case discussion with content while preserving the face-to-face, educational dynamic of questioning, listening, and response. We find that integration of this instructional technology early in the medical school curriculum, establishes the groundwork for interdisciplinary professional communication.

Conclusion

It is critical to assess whether various technologies can indeed enhance the educational process. At times, the excitement surrounding these novel tools centers on the technology itself rather than its utility and purpose. Medical educators can no longer afford to promote amalgams of disparate instructional technologies that miss the interdisciplinary process of medical care. Creating interdisciplinary systems that support the educational process can result in a fundamentally different set of educational tools, going beyond content and into the realm of a new, user-driven interdisciplinary paradigm that enhances the core principles of PBL. By emphasizing hypothesis-driven problem solving, decision-making, collaborative strategy, communication and team management, educational technology can yield an interdisciplinary competency that shapes the new practitioner of 21st century medicine.

Acknowledgements

We thank Lisa Mayer for her editorial assistance with the manuscript.

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