

Preliminary evaluation of the Web Initiative for Surgical Education (WISE-MD)

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Abstract

Background: Major changes in health care delivery and financing have negatively impacted students' experience during the surgery clerkship, particularly their exposure to physicians' decision-making processes and to the continuity of patient care. In response to these dilemmas in surgical education, we have developed the Web Initiative for Surgical Education (WISE-MD), a comprehensive surgery clerkship curriculum delivered through multimedia teaching modules and designed to enhance exposure to surgical disease and clinical reasoning.

Methods: As part of the process of creating WISE-MD, we conducted preliminary studies to assess the impact of this computer-assisted approach on students' knowledge, clinical reasoning, and satisfaction.

Results: Compared to students who did not view the modules, early data show a trend toward improved knowledge and an improvement in clinical reasoning for students who used the WISE-MD modules. This effect was specific to the clinical content area addressed in the module seen by the students. Most students felt the module was superior to traditional teaching methods and enhanced their understanding of surgical technique and anatomy.

Conclusions: WISE-MD, a theory-driven example of a concerted technology-based approach to surgical education, has the potential to address the myriad problems of today's clinical learning environment.

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The need to improve the teaching and learning of the clinical sciences has been well documented [1]. In surgery, as in other disciplines, movement of clinical services into the ambulatory setting, fragmentation of patient care, a decrease in faculty time for teaching, and financial pressures on faculty negatively impact students' experience during the clinical years. Curricula for the surgery clerkship, which need to provide a basic introduction to the recognition and management of surgical diseases, have not adapted to the increased specialization and rapidly changing technology of recent years. These challenges, coupled with the recognition that today's students are familiar with learning through electronic media, create the imperative to systematically

incorporate new instructional technologies for teaching the clinical sciences to medical students. Ideally, these technologies would efficiently and effectively provide a knowledge base and exposure to the clinical reasoning process so that students may be cognitively more prepared to learn by participating in the ever-accelerating pace of patient care. Unfortunately, computer-based simulations and instructional modules are being developed and implemented into medical training without adequate attention to a meaningful assessment of educational outcomes [2]. We describe the preliminary assessments of the impact of the Web Initiative for Surgical Education (WISE-MD) on students' knowledge and clinical reasoning skills.

Development of WISE-MD

At the New York University (NYU) School of Medicine, development of these new instructional technologies was driven by a comprehensive review and redesign of the

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surgery clerkship. In 2001, through a systematic needs assessment, we identified a number of gaps in the core surgery clerkship curriculum, including unclear structure and expectations, variability in the students' experience depending on the hospitals and specialties to which they were assigned, and lack of consensus on the core content of the clinical curriculum [3]. As a result of this needs assessment, we recognized that the traditional approach to the clerkship was no longer adequate to prepare students, most of whom were not going to practice surgery, and was frustrating for surgeons who saw most students as poorly motivated and uninterested in observing in the operating room. Through a comprehensive literature review we identified the content topics that would make up the core curriculum. Using the resources of our Academic Educational Systems (AES) laboratory, a hypermedia research group developing rich media educational applications, we developed a series of web-based, case-centered, self-directed educational modules called Web Initiative for Surgical Education-MD (WISE-MD) for the delivery of this curriculum. The primary goals of WISE-MD were to increase student exposure to clinical cases, and to teach clinical reasoning skills and professionalism through modeling and explicit presentations ("think aloud") of physicians' decision-making.

The WISE-MD modules supplement or replace lectures [4] and compensate for reduced student, teacher and patient interaction in many ways. WISE-MD presents a comprehensive picture of patient care. This includes core knowledge, technical skills, and professional skills necessary to interact with patients, as well as the clinical reasoning skills that guide the physician's decision-making process. Basic science concepts are linked to the clinical storyline, thereby emphasizing their relevance to the clinical sciences and their importance to disease processes and decision-making. The modules offer multiple links to related material so that students can more deeply explore topics, providing an adaptive and customizable curriculum. Finally, the videos and detailed 3-dimensional animations in the modules provide a very clear overview of surgery through the juxtaposition of a "bloodless field" animation and intraoperative video footage.

Educational Theory

The design of WISE-MD as a forum for teaching clinical reasoning is based on the cognitive apprenticeship framework [5]. This instructional theory presupposes that to become competent physicians, medical students must acquire the cognitive and metacognitive strategies that guide the medical decision-making process, as well as a tacit knowledge of the professional culture that provides the basis for collective values and ways of communicating in the profession [6]. Others have found the cognitive apprenticeship framework to be an excellent tool in planning, implementing, and evaluating the clinical learning experience [7].

We conducted 2 studies to assess the impact of individual WISE-MD modules on (1) short-term knowledge gain and students' satisfaction, and (2) clinical reasoning skills. Each study was approved by the NYU School of Medicine Institutional Review Board and all students provided written consent.

WISE-MD Evaluation

Study no. 1: impact on knowledge, clinical reasoning, satisfaction, and motivation to learn

Methods: Students on 4 consecutive 8-week surgery clerkship rotations were randomly assigned to complete the Carotid module during the first half of the clerkship with no access to the module after this point. These students were repeatedly encouraged to view the module. The control group was given access to the module only during in the second half of the rotation. These students received no encouragement to view the module. All students completed the knowledge test and the Script Concordance Test (SCT) at the beginning and end of the clerkship.

Measures: A 17-item multiple choice test, modeled after the "licensing board-type" tests [8], was developed specifically to test factual knowledge presented in the Carotid module (Cronbach's alpha of .7 indicating moderate inter-rater reliability).

The SCT is a written simulation tool extensively studied by Charlin et al, who showed it to be a potentially powerful measure of *clinical reasoning* [9–14]. The test places examinees in challenging authentic clinical situations (through brief written vignettes) and asks them to assess the impact of new data on diagnosis, as well as diagnostic testing and treatment options. We used the SCT development method described in the literature [15,16], which follows the key-feature approach. The scoring process involves weighting responses based on their correlation to the responses of an expert panel. Twenty-two faculty experts completed the SCTs to provide expert scores against which to weight students' responses. SCT scores range from 1 to 100, indicating increasing concordance with experts. We developed SCTs to measure clinical reasoning skills specific to the content of the module (symptomatic carotid disease, 6 items), and in clinically related areas including; asymptomatic carotid disease [6 items], coronary artery disease [11 items], lower extremity arterial occlusion [10 items], and recurring transient ischemic attacks [6 items]. **Table 1** shows an example of a vignette and 4 items regarding diagnostic reasoning.

Students also completed a 13-item survey at the end of the clerkship measuring their satisfaction with the educational value of the module and its impact on their learning experience using a scale measuring strength of agreement with survey items.

Study no. 2: impact on clinical reasoning

Methods: On the first day of 2 consecutive 8-week surgical clerkship rotations, after viewing a videotaped clinical encounter between a physician and patient with abdominal pain, students completed both a Written Clinical Reasoning Exercise (WCRE) and a subject specific SCT for cholecystitis, 2 tools designed to assess students' clinical reasoning skills. All students were given access to but not required to use the Cholecystitis WISE-MD module. On the last day of the clerkship, all students repeated the WCRE based on their interaction with a standardized patient with a painless gastrointestinal bleed and completed the same SCT.

Measures: The WCRE requires students to develop and support a differential diagnosis based on their observation

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