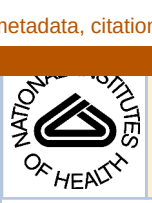

Published in final edited form as:

Am J Clin Nutr. 2006 April ; 83(4): 956S–962S.

The evolution of Nutrition in Medicine, a computer-assisted nutrition curriculum,[2,3]

Karen C Lindell, **Kelly M Adams**, **Martin Kohlmeier**, and **Steven H Zeisel**[4]

Department of Nutrition, School of Public Health, School of Medicine, University of North Carolina at Chapel Hill.

Abstract

The primary mission of the Nutrition in Medicine (NIM) project is to provide tools to facilitate the nutrition training of undergraduate medical students. NIM has developed and distributed a CD-ROM–based nutrition curriculum to medical schools since 1995. However, the medical school environment is changing rapidly; there is pressure to do more in less time, and many schools are emphasizing independent and integrated learning. The need for a nutrition curriculum that is more flexible and more accessible has driven the evolution of the NIM curriculum from CD-ROM–based delivery into a more modular curriculum with Web delivery. Such changes facilitate access and eliminate the need for installation of CD-ROMs and the associated technical support issues. In addition, the instructional units are smaller and more modular. Eventually, the authoring system will allow instructors to put together a course to meet their specific instructional needs. Our future plans also include custom-tailoring that will allow students to opt out of learning material on the basis of pretest scores if they are already proficient in the content. In this update, we provide a detailed description of the new system and the rationale for the modifications we made. Furthermore, we describe how each change addresses barriers to nutrition education as identified from our surveys and others and from direct user feedback. These innovative strategies should allow a better fit of NIM within diverse medical school environments and help to promote incorporation of the curriculum into more medical schools.

Keywords

Nutrition education; medical education; nutrition; Nutrition in Medicine; medical school curriculum; medical students; education; nutrition curriculum; computer-based learning; computer-assisted instruction; computer-based instruction

---

[2]Presented at the symposium “An Evidence-Based Approach to Medical Nutrition Education,” held at Experimental Biology 2005 in San Diego, CA, 2 April 2005

[3]The Nutrition in Medicine project is supported in part by grants from the NIH (National Cancer Institute and Office of Dietary Supplements R25 CA65474), the American Institute for Cancer Research, Baxter Healthcare Corporation, Bristol-Myers Squibb Company, Clintec International Inc, the Dannon Institute, the Egg Nutrition Board, the Gatorade Company, the Kellogg Company, the National Cattlemen's Beef Association, the National Dairy Council, Nestlé Clinical Nutrition, New York Community Trust, Novartis Nutritionals, Perrigo of South Carolina, Quaker Oats Foundation, Ross Products Division/Abbott Laboratories, Solae Company, the US Department of Agriculture, The University of North Carolina at Chapel Hill, and Wyeth-Ayerst Laboratories. This work was also supported by the UNC Clinical Nutrition Research Unit (DK56350).

[4]Reprints not available. Address correspondence to SH Zeisel, Department of Nutrition, University of North Carolina at Chapel Hill, CB#7461, Chapel Hill, NC 27599. E-mail: steven_zeisel@unc.edu.

None of the other authors had any conflicts of interest.

INTRODUCTION

The mission of the Nutrition in Medicine (NIM) project at the University of North Carolina at Chapel Hill is to develop a core curriculum in nutrition for medical students that covers the preventive and therapeutic aspects of nutrition, spans the preclinical and clinical training of physicians, and is flexible and interactive. Since 1995 the NIM project has developed, updated, and distributed free of charge to all US medical schools a CD-based nutrition curriculum. This curriculum consists of 10 titles (Table 1) and provides many opportunities for the student to apply knowledge and build experience; such approaches may result in greater success in preparing students to deliver health-promoting services confidently. Efficacy data for several of the titles have been published elsewhere, as has a detailed description of the curriculum (1-4).

In brief, each CD-ROM educational module contains lessons that teach basic nutrition science and center around patient cases. In the video case segments, the virtual mentor asks the student to apply the knowledge learned in the lessons. Interactive exercises and animations are included within lessons, along with pop quizzes and short case studies. Each section begins with learning objectives and ends with key concepts. Hyperlinked text in the lessons takes the user to the glossary section of the references where they can view a definition of the term; other items included in the references include diagnostic tests, nutrient allowances, a bibliography, and in the most recent titles, a supplement index. Three board-type exams are accessible at any time.

The curriculum topics and coverage are based on the American Society for Clinical Nutrition's consensus guidelines (5). The currently available CD content addresses most other published recommendations as well, including most of the recently published Nutrition Academic Award's *Nutrition Curriculum Guide* (6-11). Content is developed by faculty of the Department of Nutrition at the University of North Carolina at Chapel Hill, which is part of both the School of Public Health and the School of Medicine. Furthermore, content review and direction are provided by an advisory board of medical educators and nutrition experts from academia, government, and industry. Because many medical schools do not have faculty who are experts in nutrition, this system provides a credible and consistent source of nutrition information for such institutions.

The CD-ROM system provides a means of delivering consistent nutrition education across institutions and instructors. Our database records indicate that this curriculum has been distributed to all 125 US medical schools, to most US osteopathic schools, and to 110 international medical schools. Ongoing surveys show that at least 129 medical schools use the modules in some way (92 US schools, 37 international schools), and an additional 56 medical schools are planning on using or are evaluating the modules for incorporation. Fifty US medical schools are actively using one or more titles as an integral part of a course. The purpose of this report is to describe the evolution of NIM in response to the barriers identified by us and others (4,12-15). Ultimately, we expect these advances will help to reach our goal of incorporating more nutrition into the curriculum and will better meet instructors' needs.

RATIONALE

A recent editorial addressing the need for innovative teaching strategies in training future physicians in nutrition summarizes some of the challenges, which include the lack of time in the curriculum to add lectures or courses and the changing nature of how medical education is delivered (16). Other barriers include an emphasis on curative medicine, which largely ignores the role of nutrition in disease prevention; competing topics; lack of a nutrition advocate; lack of agreement on what to teach; difficulty of integrating nutrition education in all schools; and more (17-19).

Although our surveys of NIM users indicate that the CDROM–based curriculum is helping to get more nutrition education into medical schools, they also served to identify several barriers to using the CD-ROM format as well as to incorporating more nutrition in general. These barriers and the new approaches we have taken to address these issues are summarized in Table 2.

We agree with others that incorporating adequate nutrition education into the curriculum requires more innovative strategies (13,16,19), and NIM is responding by making key changes in our computer-assisted curriculum. Our surveys tell us that most of the nutrition education at US medical schools is integrated into other types of courses (20); hence, there is a need for a flexible curriculum that can be incorporated into a wide variety of course formats. Numerous studies document the efficacy of computer-assisted instruction in medical education; knowledge, confidence, and clinical behaviors can be enhanced through these means (21,22). Our overarching goal is to eliminate some of the barriers to improve both the quality and quantity of nutrition instruction.

THE EVOLUTION OF NUTRITION IN MEDICINE

NIM is evolving to become even more flexible and accessible—the entire curriculum is moving to the Web (Internet: www.nutritioninmedicine.org). For medical school users only, registration (no subscription or fees required) and log-in are all that are necessary to view the course listings (Figure 1). The Web-based curriculum will retain most of the features of the CD-ROM–based curriculum (eg, learning objectives, lesson content with embedded patient cases, opportunities for self-assessment, and applications through case scenarios with remediation, pop quizzes, etc). The look and feel of the program has been updated; there is more consistency in layout, functionality, and organization for users (Figure 2). New features include increased accessibility of documents and interactive tools for downloading, sections on clinical skill building, and a continually updated resources section.

NEW CONTENT

Several online modules will be available beginning in fall 2005. With the launch of our online delivery system, we simultaneously released a new course: Pediatric Overweight. This set of modules builds and expands on the more limited obesity content contained in Nutrition and Growth. Pediatric Overweight presents a detailed overview of the problem and the etiology of overweight in the pediatric population and addresses prevention and treatment. With the alarming rise in pediatric overweight, this is a key topic for training future physicians. The full range of Web-based modules will be completed by 2007 and will be continually updated thereafter.

MODULAR SYSTEM

A distinctive feature of the new curriculum is its modular approach to instruction. The Web-based curriculum will consist of multiple discrete instructional units. Each unit contains content designed to meet one specific learning objective; thus, these units are the building blocks of each learning module. This organization into smaller instructional units allows the NIM team to construct modules that are tailored to specific needs. For example, obesity coverage is listed as a top priority by nutrition educators and by physicians in practice (5,11,23,24). Currently, 2 different CD-ROM modules contain sections on adult obesity (“Diet, Obesity and Cardiovascular Disease” and “Diabetes and Weight Management”). In the past, students had to access both CDs for complete coverage. The NIM team is now able to construct modules that focus strictly on this topic by combining self-contained smaller units. Several standard modules will be available that are likely to meet the needs of many instructors; instructors can collaborate with the NIM team to further tailor modules.

This ability to tailor content should facilitate the creation of assignments that take into account both the knowledge level of the students and the time available in the curriculum. In addition, the content from the existing NIM titles will be available in shorter, more time-manageable learning modules. Being able to access smaller, more targeted instructional units may help faculty to bridge gaps in knowledge and awareness that have been identified by us and others (25).

OTHER MODIFICATIONS

Another distinctive feature is the new format for the Case Practices; these video segments are shorter and more targeted to focus on specific clinical skills. This modification makes the most effective use of limited time in the curriculum and portrays the reality of clinical practice today.

We have also added several new features: Page Notes, User Notes, Options, and Outline. Page Notes provide information specific to a page's content, for example, a citation or other relevant resources. In addition, it will contain the date the information was last reviewed or updated; we expect this will be extremely useful to the instructor. In fact, this has been used as one way to gauge reliable and credible sources of Internet information by the now defunct Tufts Nutrition Navigator and others (26,27). User Notes enable the instructor, student, or content reviewer to take notes electronically as they proceed through the module; these notes can then be e-mailed to the instructor or student (or to us to provide feedback) or they can be printed out. The print function under Options (accessed from the menu bar) allows an entire lesson page to be printed out. The Outline feature can be used to navigate the content or to provide a quick overview of a module's content in a familiar outline format. Many of these additions are a direct result of user feedback.

UPDATING CAPABILITY

Because nutrition science and guidelines constantly evolve, a comprehensive curriculum must be able to do so also. A distinct advantage of the new system relates to the ease of updating material and the immediate accessibility to that information once it is posted. The lengthy process of testing, CD-ROM pressing, and mailing of the past is bypassed. For example, with the release of the new MyPyramid graphic, the old Food Guide Pyramid was replaced and available in our content almost immediately. In addition, any identified gaps can be more easily filled with the modular approach. If a module on women's health was desired, for example, most of the components are already available; the addition of a few new units could complete the content. Such rapid updates and changes simply were not possible with the old system.

INSTRUCTOR TRAINING

In a previous publication, we reported that faculty need *1*)to be shown how to use and integrate computer-assisted instructional tools into their courses, *2*) adequate support in terms of training and technical problem-solving, and *3*) easy access (4). Many of the changes to the curriculum described above address some of these issues. Another innovative approach to getting nutrition education into the curriculum has been to initiate an effort to help train the trainers. An instructor workshop, held by NIM for the first time in 2004, provided the opportunity to exchange information, share ideas to overcome barriers, learn about implementation experiences from other faculty who were using the programs, provide an update on future directions, and get specific feedback. Instructors stated (both at this meeting and on our 2001 user survey) that Web delivery and access would help the most to promote implementation of the curriculum. Workshop instructors also noted the ability to tailor the content as a major advance and requested periodic workshops to learn about customizing tools and ways to implement the programs. In addition, they voiced the need for impact evaluation data. All of

these issues are addressed, or are on their way to being addressed, with the new capabilities of the NIM curriculum (Table 2).

FUTURE DIRECTIONS

Our coverage is expanding beyond basic nutrition science toward the clinical skills relevant for third- and fourth-year students. Specifically, we are adding instructional components on diagnostic procedures, algorithms for clinical interventions, and expanded interactive case discussions.

Soon, individual instructors will be able to build their own modules by putting together combinations of teaching units that meet their specific instructional needs. A Web-based support program (Wizard) will allow authorized instructors to choose the module that most closely approximates their instructional needs and then add or delete units as they see fit. A preliminary prototype interface is illustrated in Figure 3. The left-hand side of the module builder window displays the components of the module under construction. Thumbnail images of the individual pages within a selected unit are shown next to the list of instructional units. The right-hand half of the window is used to search for and display units that might be added to the module under construction.

Another focus of our development efforts will be on evaluation. For this purpose, we will construct units containing specialized test questions that broadly target the content under evaluation. The responses to the questions will be collected anonymously and used to assess knowledge gain. On the basis of the findings, test questions can be refined and the instructional content of the unit improved. The users will not be burdened significantly by the evaluation process because evaluation questions will be used sparingly and will be randomly distributed among users. In addition, each question will be followed by detailed remediation and will thus contribute to the learning process. This seamless integration of evaluation into the instructional flow will support a continuous process of iterative improvement of the instruction. In addition, pre- and posttest capabilities round out the evaluation features of the Web-based system.

These same evaluation components will eventually be used to implement an adaptive instructional model. Depending on their performance on pretest questions, students will not have to spend time studying material they are already familiar with and will be guided only to units covering new topics or specific knowledge gaps. As shown in an earlier study, such adaptive instruction can optimize valuable curriculum time (28). Ultimately, all of our interactive tools, clinical guidelines, and other relevant practice statements will be available from the menu bar so that students and instructors can access them directly.

CONCLUSION

The new innovative features of the NIM curriculum will make the programs more accessible and better suited for the changing face of medical education. We expect that our Web-based curriculum will aid instructors with course preparation and facilitate training of future physicians in this critical area.

Acknowledgements

KCL and KMA were primarily responsible for drafting this article, which is based on SHZ's presentation at the symposium. SHZ is principal investigator of the NIM project. Both MK and SHZ contributed to writing and editing the manuscript. SHZ has a financial interest in a publishing company that offers some of the NIM content for continuing education. KCL served as a paid consultant for one of the NIM funders on an unrelated project.

REFERENCES

1. Ashley J, Jeor S, Perumean-Chaney S, et al. Transition over three years using a multimedia computer-based module for educating medical students in cancer and nutrition. J Cancer Educ 1999;14:10.abstr
2. Buchowski MS, Plaisted C, Fort J, Zeisel SH. Computer-assisted teaching of nutritional anemias and diabetes to first-year medical students. Am J Clin Nutr 2002;75:154–61. [PubMed: 11756073]
3. Kohlmeier M, Althouse L, Stritter F, Zeisel SH. Introducing cancer nutrition to medical students: effectiveness of computer-based instruction. Am J Clin Nutr 2000;71:873–7. [PubMed: 10731491]
4. Cooksey K, Kohlmeier M, Plaisted C, Adams K, Zeisel SH. Getting nutrition education into medical schools: a computer-based approach. Am J Clin Nutr 2000;72(suppl):868S–76S. [PubMed: 10966915]
5. Weinsier RL, Boker JR, Brooks CM, et al. Priorities for nutrition content in a medical school curriculum: a national consensus of medical educators. Am J Clin Nutr 1989;50:707–12. [PubMed: 2801575]
6. American Medical Student Association's Nutrition Curriculum Project. Essentials of nutrition education in medical schools: a national consensus. Acad Med 1996;71:969–71. [PubMed: 9125984]
7. Subcommittee on Curriculum Development. The American College of Nutrition Medical Nutrition Education Curriculum Development white paper. American College of Nutrition; Clearwater, FL: 2000.
8. Committee on Medical/Dental School and Residency Nutrition Education. Priorities for nutrition content within a medical school curriculum: a national consensus of medical educators. American Society for Clinical Nutrition. Acad Med 1990;65:538–40. [PubMed: 2383338]
9. Group on Nutrition Education. Physician's curriculum in clinical nutrition: a competency-based approach for primary care. Society of Teachers of Family Medicine and Ross Products Division, Abbott Laboratories; Kansas City, MO: 1995.
10. National Academy of Sciences. Nutrition education in U.S. medical schools. National Academy Press; Washington, DC: 1985.
11. Curriculum Committee of the Nutrition Academic Award Program. Nutrition curriculum guide for training physician practice, behavior, skills and attitudes across the curriculum. 2002. Internet: http://www.nhlbi.nih.gov/funding/training/naa/curr_gde.pdf (accessed 31 May 2005)
12. Armstrong EG, Koffman RG. Enhancing nutrition education through faculty development: from workshops to Web sites. Am J Clin Nutr 2000;72(suppl):877S–81S. [PubMed: 10966916]
13. Pearson TA, Stone EJ, Grundy SM, McBride PE, Van Horn L, Tobin BW. Translation of nutritional sciences into medical education: the Nutrition Academic Award Program. Am J Clin Nutr 2001;74:164–70. [PubMed: 11470716]
14. Young EA. Nutrition education in US medical schools. Am J Clin Nutr 1997;65:1558. [PubMed: 9129492]
15. Schulman, J. Nutrition education in medical schools: trends and implications for health educators. Med Ed Online [serial online]. 2000. Internet: http://www.med-ed-Online.org/f0000015.htm (accessed 31 May 2005)
16. Walker WA. Innovative teaching strategies for training physicians in clinical nutrition: an overview. J Nutr 2003;133:541S–3S. [PubMed: 12566498]
17. Bruer, RA.; Schmidt, RE.; Chapel, T. Nutrition education for physicians: alternative federal roles for creating an improved system. Richard Schmidt Associates, Ltd, Macro International, Inc; Springfield, VA: 1993. [PB93-189074]
18. Makowske M, Feinman RD. Nutrition education: a questionnaire for assessment and teaching. Nutr J 2005;4:2. [PubMed: 15649324]
19. Touger-Decker R. Nutrition education of medical and dental students: innovation through curriculum integration. Am J Clin Nutr 2004;79:198–203. [PubMed: 14749223]
20. Adams KM, Lindell KC, Kohlmeier M, Zeisel SH. Status of nutrition education in medical schools. Am J Clin Nutr 2006;83(suppl):941S–4S. [PubMed: 16600952]
21. Hillenbrand KM, Larsen PG. Effect of an educational intervention about breastfeeding on the knowledge, confidence, and behaviors of pediatric resident physicians. Pediatrics [serial online] 2002;110:e59.Internet: http://pediatrics.aappublications.org/cgi/content/full/110/5/e59 (accessed 2 February 2006)

22. Maiburg BH, Rethans JJ, Schuwirth LW, Mathus-Vliegen LM, van Ree JW. Controlled trial of effect of computer-based nutrition course on knowledge and practice of general practitioner trainees. Am J Clin Nutr 2003;77(suppl):1019S–24S. [PubMed: 12663311]

23. Story MT, Neumark-Stzainer DR, Sherwood NE, et al. Management of child and adolescent obesity: attitudes, barriers, skills, and training needs among health care professionals. Pediatrics 2002;110:210–4. [PubMed: 12093997]

24. Mihalynuk TV, Knopp RH, Scott CS, Coombs JB. Physician informational needs in providing nutritional guidance to patients. Fam Med 2004;36:722–6. [PubMed: 15531987]

25. Wong V, Millen BE, Geller AC, Rogers AE, Maury JJ, Prout MN. What's in store for medical students? Awareness and utilization of expert nutrition guidelines among medical school preceptors. Prev Med 2004;39:753–9. [PubMed: 15351542]

26. Health Summit Working Group. Criteria for assessing the quality of health information on the internet —policy paper. 1999. Internet: http://hitiweb.mitretek.org/docs/policy.html (accessed 8 June 2005)

27. Liebermann, J. Evaluating health Web sites. Consumer health: an online manual. 2000. Internet: http://nnlm.gov/scr/conhlth/evalsite.htm (accessed 9 June 2005)

28. Kohlmeier M, McConathy WJ, Cooksey Lindell K, Zeisel SH. Adapting the contents of computer-based instruction based on knowledge tests maintains effectiveness of nutrition education. Am J Clin Nutr 2003;77(suppl):1025S–7S. [PubMed: 12663312]

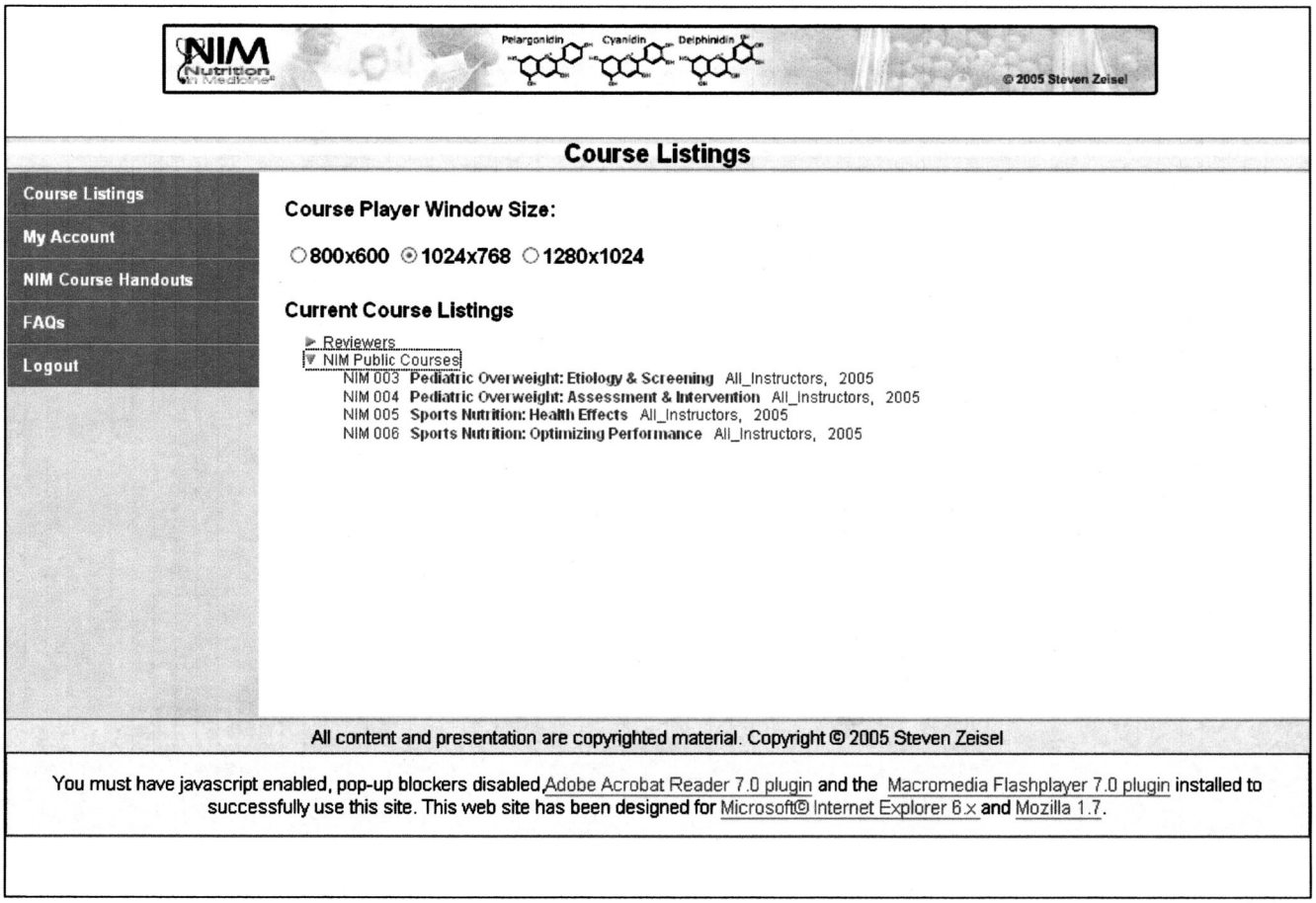

FIGURE 1.
Web interface showing sample course listing for Nutrition in Medicine (Internet: www.nutritioninmedicine.org).

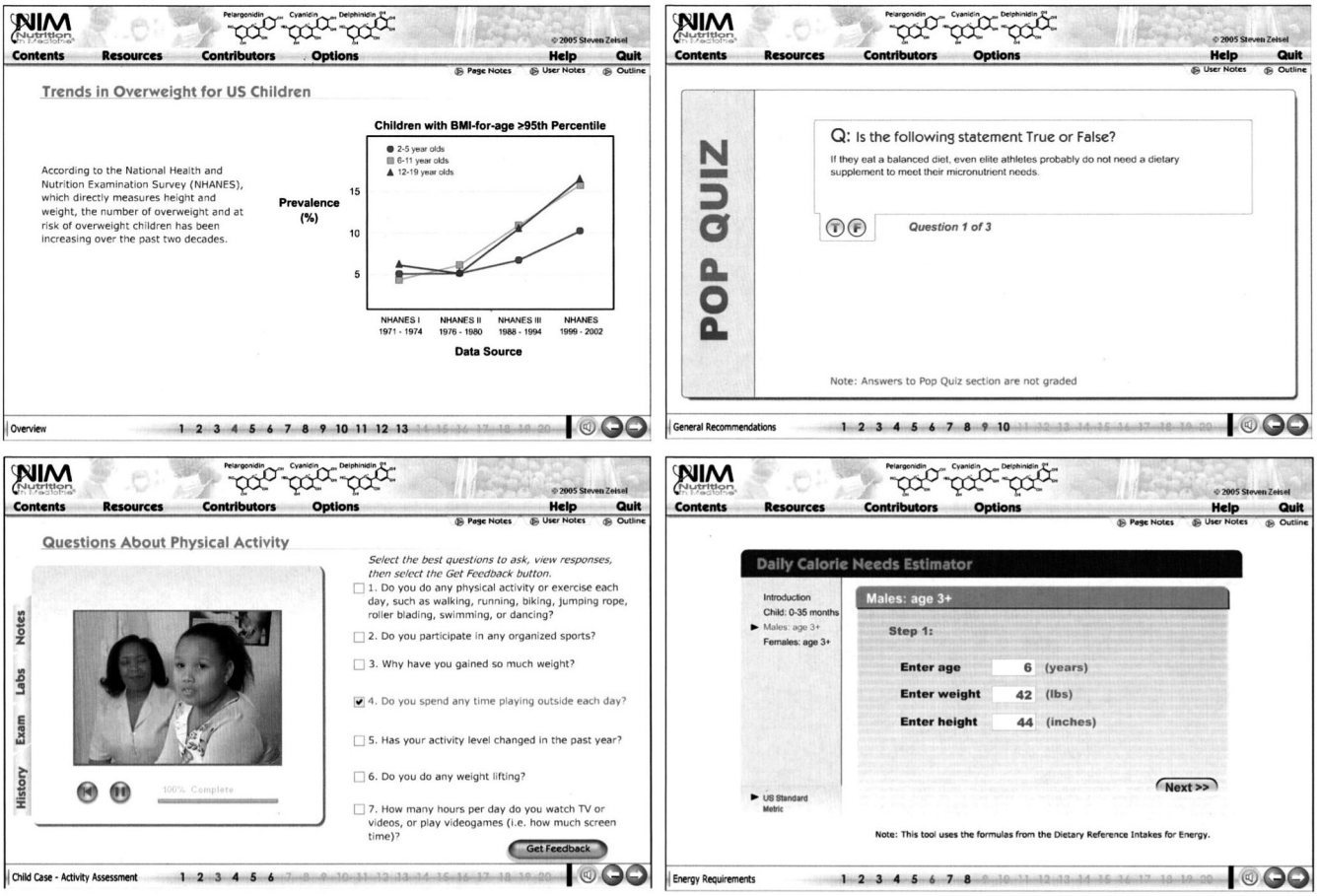

FIGURE 2.

Sample screens from the Web-based Nutrition in Medicine curriculum. Clockwise from top left: lesson page; a pop quiz to reinforce concepts and self-assess knowledge; an interactive tool to estimate daily calorie needs; and a video-based case study.

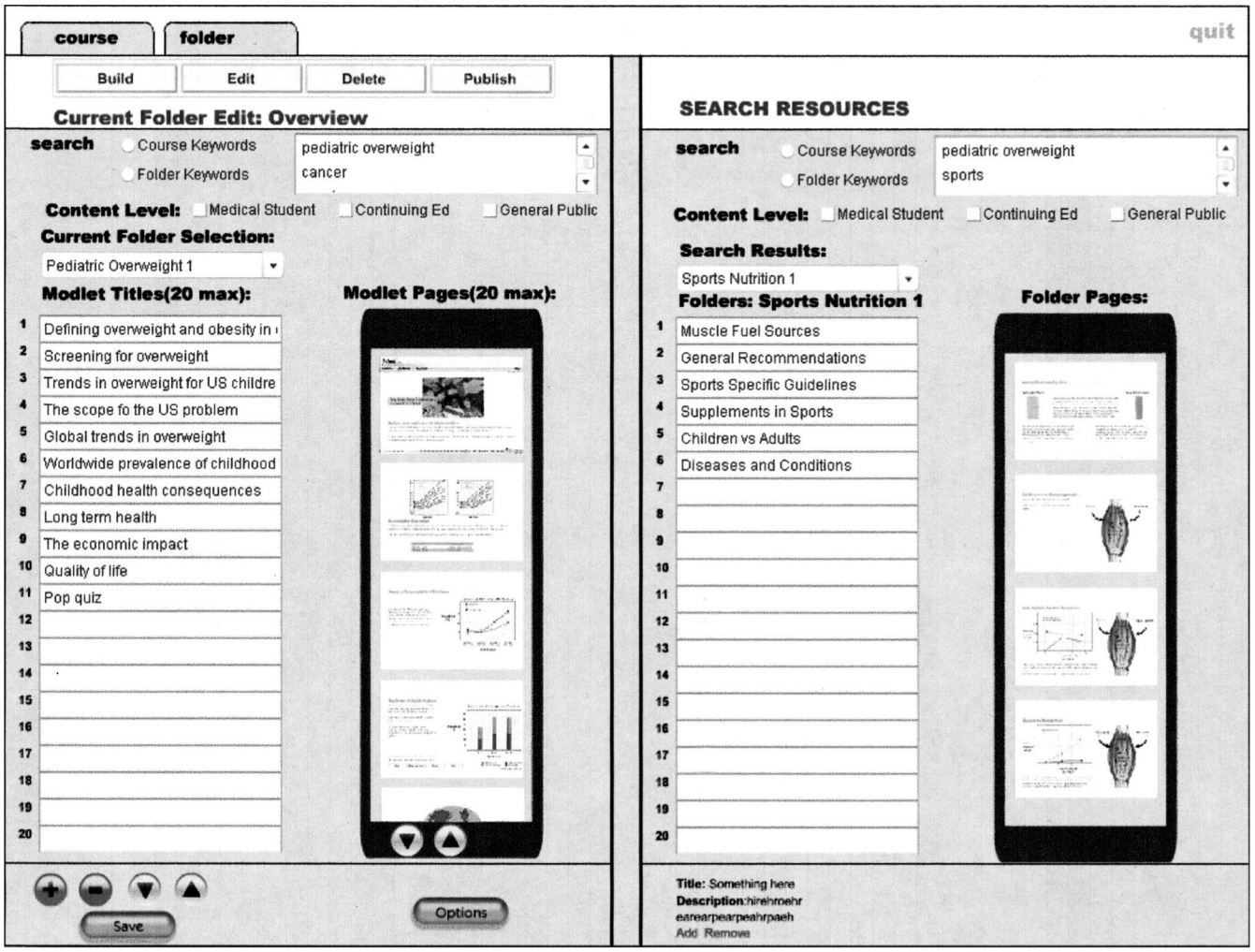

FIGURE 3.

Interface for instructor authoring. We plan to make it possible for instructors to select from among the course components offered in Nutrition in Medicine (NIM) to create their own customized courses. Instructors will be able to search for content units (right panel) and drag them into course modules that they are creating (left panel). Once having done so, they can rearrange the ordering of units and then post the course on the NIM website for their students to access. This feature should be available in 2006.

TABLE 1

Titles in the Nutrition in Medicine CD-ROM curriculum

Series	Titles
The Disease Series	Nutritional Anemias
	Nutrition and Metabolic Stress
	Nutrition and Cancer
	Diet, Obesity, and Cardiovascular Disease
	Diabetes and Weight Management: Aberrations in Glucose Metabolism
The Lifecycle Series	Maternal and Infant Nutrition
	Nutrition and Growth
	Nutrition for the Second Half of Life
Special Topics in Nutrition	Dietary Supplements and Fortified Foods
	Sports Nutrition: Physical Activity and Health

TABLE 2

Strategies to overcome barriers to nutrition education and utilization of Nutrition in Medicine (NIM) in medical schools

Barrier	Old CD strategy	New NIM strategies			Future NIM strategies		
		Web delivery	Modular units	Instructor workshop	Authoring and search capacity	Adaptive learning	Online efficacy evaluation
Limited curriculum time	Complete curriculum of ten 2–3-h modules that can be used to replace a lecture or can be done on student's own time		X		X	X	
Limited classroom time	As above	X	X		X	X	
Convincing administrators and other faculty to use the curriculum	Attend national meetings, make presentations, publish papers, travel to individual institutions	X					X
Difficulty integrating nutrition education curriculum across all schools	Standardized and consistent content available to all medical schools that cover major priority topics (5)		X				
Uncertainty of where to incorporate into the curriculum	Curriculum organized by disease, lifespan, or special topic		X	X	X		
Difficulty implementing (inadequate computer support staff, cost of purchasing computers and CD-ROMs)	Instructor Support Manual Provide up to 5 copies per title	X			X		
Faculty responsible for nutrition education are not always formally trained in or comfortable with teaching all aspects of nutrition	Fully developed content available				X		
Difficulty keeping content current because of rapidly changing state of science	Periodic content updates as needed; plan to routinely update every 2 y after series completion Press new CD and distribute by mail	X					