

Web-based Dosimetry Training Program

Arthur L. Boyer, Ph.D.

The critical shortage of medical dosimetrists will require innovative methods to educate new personnel rapidly and adequately use limited resources. Distance learning through a world wide web site offers the opportunity for resources to be pooled to create a comprehensive teaching tool that can be used at multiple sites by many mentors. A Dosimetrists' Training Tool (DTT) has been under development funded a grant awarded by the National Cancer Institute entitled "Web-based Computer-Aided Instruction for Medical Dosimetrists. The web-based software will provide a tool to relieve Mentors from the task of developing and administering approximately 500-600 hours of didactic training to their Students. The tool consists of 25 Course Modules. Each small course module consists of approximately 20 training sessions. The course content has been developed by volunteer Module Authors assisted by the Staff at Stanford. The DTT group at Stanford

decided to develop an HTML-based content delivery software system. The newly designed Web-based Dosimetry Training Tool has many features added to it and allows for more control for both mentors and students than did the commercial software that was licenses originally to deliver the content. Perhaps the most significant feature of the new

DTT is a means for the Mentors to schedule post-quizzes for their students and to review the automated quiz scoring independent of management by the Stanford staff. The revised Dosimetry Training Tools are available through a new DTT web portal:

<http://www.radoncelearning.com/dtt/portal/portal>

Mentors.

The training tools are being put in the hands of training programs and mentors across the country. The programs or individual mentors have the primary responsibility of training the students. The responsibility of certifying training programs and mentors remains with other parties, in particular the AAMD. The tools are available without charge to all appropriate mentors and programs. Oversight of the mentor pool is provided by the

The screenshot shows the homepage of the Web-based Dosimetry Training Tool. At the top left is the Stanford School of Medicine logo. The main heading is "Web-Based Dosimetry Training Tool". Below this is a navigation menu with links for Home, FAQ, News, Contact, and Links. A secondary menu includes Overview, Mentors, Students, Authors, Modules, and Our Staff. The main content area features a large heading "Web-based Dosimetry Training Tool" followed by a paragraph describing the tool's purpose and development. A "Login" section on the right includes fields for Email and Password, a Sign In button, and a link for "Forgot your password?". A note at the bottom of the main content area states that the tool is currently available to the public and is undergoing development, with post-tests scheduled for summer 2005. The footer contains copyright information for Arthur L. Boyer, Ph.D., at the Stanford School of Medicine, Radiation Physics Division, Radiation Oncology Department.

American Association of Physicists in Medicine (AAPM) and the American Association of Medical Dosimetrists (AAMD). The AAPM oversight is provided through the "Training and Practice of Medical Dosimetry" Subcommittee (Larry Sweeney, Ph.D. <LESweeney@providence.org>, Subcommittee Chair), a subcommittee of the "Medical Physics Education of Allied Health Professionals" Committee (Beth A. Schueler, Ph.D. schueler.beth@mayo.edu Committee Chair). The AAMD oversight is provided by the AAMD Education Committee. Mentors must be qualified by this process to gain access to the new DTT web portal. Pending mentors and their students will not be able to gain access until they have completed the mentor review process. One can apply to be a mentor by filling out an On-Line Application that can be accessed at <http://www.radoncelearning.com>. Using the revised DTT software Mentors now have the ability to:

1. Update their profile (to change location or email address). Add, delete and update their student's profile/s. All of these features are available in the "Admin" tab once the mentor has entered their login.
2. Add sub-mentors (if needed) and assign students to them.
3. Review pre-quizzes / post-quizzes and send in a report to the DTT staff for corrections, problems and/or updates.
4. Release post-quizzes for the Mentor's students and view their results online. (Pre-quizzes are a 1 time mandatory item for students only and need not have a release function).
5. Search "All Sessions", "Current Sessions" and terminologies within the Dictionary.

Students

The tool consists of 25 Course Modules. Each small course module will consist of approximately 20 training sessions. Each session will have a session title and will contain a list of instructional objectives. Each Course Module will be preceded by a pre-quiz, and will end with a final exam or post-quiz.

Access to the tools will be through a password protected web portal. Student accounts and passwords will be provided to students without charge for as long as the project is funded by the NCI (currently until mid 2007). However, accounts will be set up only through Mentors who have been qualified to enroll students to use the tool. The tools are being developed for Mentors who accept the responsibility for the students' training.

The project will maintain a record of prospective student applicants and will try to match them with Mentors. Prospective students can fill out an On-Line Student Application as the portal <http://www.radoncelearning.com>.

Course Modules

The tool will consist of 25 course modules. Each small course module will consist of approximately 20 training sessions. Each session will have a session title and will contain a list of instructional objectives. Each course module will be preceded by a pre-quiz consisting of approximately 10-20 questions, and will end with a final exam consisting of up to 50 questions. The modules are listed in the table below:

Medical Dosimetrist Course Module Titles

- 1 Fundamentals of Clinical Oncology
- 2 Anatomy for Medical Dosimetrists
- 3 Radiobiology for Medical Dosimetrists
- 4 Fundamentals of Radiation Safety
- 5 Physics Fundamentals for Radiation Therapy
- 6 Production of Teletherapy Radiation
- 7 Sources for Brachytherapy
- 8 Introduction to Radiological Imaging
- 9 Introduction to Dosimetry Instrumentation
- 10 Measurement of Dose in Radiation Oncology
- 11 Introduction to Teletherapy Dose Calculation
- 12 Introduction to Brachytherapy Dose Calculations
- 13 Teletherapy Treatment Planning
- 14 Brachytherapy Treatment Planning
- 15 Practice Dosimetry Problems
- 16 Radiographic and Virtual Simulation
- 17 Three-Dimensional Conformal Radiotherapy
- 18 Treatment Planning for High Dose-Rate Brachytherapy
- 19 Introduction to Radiotherapy by Permanent Seed Implants
- 20 Treatment Planning for Stereotactic Radiosurgery
- 21 Treatment Planning for Intensity-Modulated Radiotherapy
- 22 Dosimetric Quality Assurance for Radiation Oncology
- 23 Professional Issues for Medical Dosimetrists
- 24 Math Skills

Module Authors

The development of the program will depend upon about volunteer authors. The modules will be authored by volunteers from the AAMD, ASTRO, and the AAPM. The first edition of the tool have been authored over three years. The modules will be revised and upgraded over the final two years of the NCI funding.

Each session has a session title and contains a list of instructional objectives. The titles and instructional objectives of the sessions are being developed by the module authors assisted by an Educational Consultant at Stanford. One primary author will be responsible for the module, but can be joined by as many coauthors as is practical. The authors will be primarily responsible for developing the instructional objectives, exam

questions, and the course material in the form of text and graphics. The training sessions will consist of approximately 20 HyperText Markup Language (HTML) pages in a path followed by approximately 20 self-test quiz questions. The authors have been uploading at minimum the material for about 150 HTML pages per year for three years to the Project Manager at Stanford who has been responsible for getting the material converted to HTML pages in a path specified by the author within the program.

In addition to exam items prepared by the primary authors, the project has been assisted by Govinda Rajan who has served as a Consultant for the project during 2004-2005. Govinda has reviewed the modules and has augmented the original exam items to provide a pool of items from which final exams can be drawn. The Educational Consultant has assisted in the development of valid questions. The questions are being uploaded into a directory. Exam questions can be rotated periodically into the pre-quizzes and final exams.

The current status of the project can be summarized as follows:

- Didactic and quiz content ~80% complete
- Current user statistics:
 - Participating Authors = 70+
 - Approved mentors = 100
 - Pending mentors = 84
 - Approved students w/mentors = 184
 - Students applicants in need of mentors = 293

One may volunteer to be an author by filling out an On-Line Author Application at the portal <http://www.radoncelearning.com>.

Staff at Stanford

Arthur L. Boyer, Ph.D., Principal Investigator.

Dr. Boyer is a Professor in Radiation Physics at Stanford University School of Medicine. He serves as Director of the Radiation Physics Division of the Radiation Oncology Department. He has taught physics to Radiation Oncology Residents continuously since 1971, and has taught anatomy for dosimetrists and physicists since 1983. Dr. Boyer currently serves an appointment as Liaison to the American Association of Medical Dosimetrists for the American Association of Physicists in Medicine. Dr. Boyer assumes responsibility for all aspects of this project, ensuring that research goals are met in a timely manner with scientific integrity, that the work is done within budgeted amounts and is in complete compliance with the University and funding agency regulations. He organizes and chairs regular meetings of the Stanford Staff and Dr. Dev. Dr. Boyer will organize the annual Workshop at the AAMD meeting to review the project with the authors.

Parvati Dev, PhD., Collaborator

Parvati Dev, PhD, is Director of the SUMMIT group at Stanford University School of Medicine, and Senior Scientist in Medical Informatics. SUMMIT (Stanford University Medical Media and Information Technologies) is a research and development group whose charter is to encourage the use of technology to further education goals. The themes of her research is on technologies to increase the efficiency and quality of education software development, including the facilitation of authoring of large, complex hypermedia documents, and on navigation in hypermedia during learning and problem-solving. She will help develop and organize the courses in the WebCT software. Dr. Dev meets regularly with the Stanford Staff and Dr. Boyer to track the progress of this work and to resolve problems. Dr. Dev will speak at the annual workshops on use of the Internet as a teaching tool.

Scot Kaylor, M.Ed., Program Director

Mr. Kaylor is an expert on the use of the Web for education. Mr. Kaylor reviews the training material transferred to the project server, renders them into HTML pages, and organizes the HTML pages within the teaching paths and assists in connecting the self-quizzes to the correct review pages. He makes revisions of the appearance of the pages to be approved by the authors. He provides telephone support for the module authors to assist them in preparing their material for submission to the project server. He will also take trips to the authors' sites to provide training and problem solving. The Project Manager will be a speaker at each of the workshops.

Doug McCune, Software Engineer.

A full-time software engineer has been added to the staff to develop and maintain the delivery software.

Pat Youngblood, Ph.D. Education Consultant.

Dr. Youngblood provides consultation on the development, revision, improvement and best use of the tool. Her services include:

1. Developing formative assessment tools to design training modules according to a competency based training approach, which focuses on the knowledge, skills and attitudes required to perform on the job tasks of the medical dosimetrist.
2. Training the developers in how to write good objectives. Assist module developers to write module instructional objectives. Critique instructional objectives proposed by the module developers.
3. Assisting module developers to write test items for each objective so these can be used for both Formative assessment and Summative Assessment.
4. Preparing a report, to be used at an annual Workshop for the module developers, containing recommendations for continuing to develop and refine the Web-based Dosimetry Training Tool.

John Hecht, Ph.D. Psychometrician

Dr. Hecht is a certified psychometrician with Credentialing Services, Inc. of Galesburg, Illinois. Dr. Hecht will guide the development of the exam question content validity panel instruments and analyze the results of pilots of the exam questions before they are put in the modules to test for design validity. Dr. Hecht will also analyze the results of the exams taken before and after each module by students using the tool to assess the reliability of the questions.