

Abstract ID: 9861 Title: Evolving Models of Medical Imaging Physics and Technology Education

The effective and safe utilization of various medical imaging modalities requires professionals (radiologists, medical physicists, and technologists) with a comprehensive and up-to-date knowledge of the physical principles of the imaging procedures along with an understanding of the technology and its operating characteristics.

Educational activities to meet these needs are characterized and often limited by issues of *effectiveness* and *efficiency*. The *effectiveness* of a learning activity determines outcomes and whether or not the learner will be capable of performing specific functions such as image quality evaluation, procedure optimization, applying appropriate risk management procedures, to name a few. The *efficiency* of a learning activity is determined by a combination of factors including financial costs, human time and effort, and institutional availability of resources.

The work of two major pioneers in the educational process, Robert Gagné and Edgar Dale, provides a valuable background and understanding of the learning process, and especially the compromises between effectiveness and efficiency.

There are several dynamic factors driving changes in the medical imaging educational process and resulting in new and evolving models. These include rapid changes in imaging technology and methods, diffusion of new technologies throughout the global healthcare system, and the need for enriched learning environments and adequately prepared learning facilitators (instructors) at the local level.

Continuing advances in digital technology are providing the infrastructure for increasing both the efficiency and effectiveness of medical imaging physics and technology education. This is being achieved by the utilization of technology to enhance (and not replace) human performance of both the learner and the learning facilitator and to create enriched learning environments.

The models of the educational systems for the future contain a combination of inter-related functions that together address the changing needs and provide solutions.

There are three major phases in the development and delivery of medical imaging physics education. They are educational resource development, resource distribution and sharing, and resource utilization. Each of these is enhanced by the availability of state-of-the-art digital technology but is also dependent on highly qualified dedicated medical physicists along with institutional and organizational values and objectives.

The development of effective learning and teaching resources requires medical physicists with applied clinical experience who also have the capability to transfer their experience into effective learning resources—that is, resources that can be used to enrich learning environments and provide experiences that are easily accessible to actual medical imaging procedures and related activities. The most significant elements in effective learning resources are images and other visual graphics depicting the various imaging technologies and procedures. Clinical images demonstrating imaging conditions and effects of imaging parameters are essential. A variety of image processing methods are used to create other highly effective teaching images and visual simulations. It is expected that simulators will become more prevalent in the future that will give learners the opportunity to observe images under interactive conditions.

The internet is revolutionizing medical imaging physics education by providing a system for distribution and sharing of resources, access to a variety of educational programs, tele-teaching, and connectivity to a worldwide knowledge base. This great value is demonstrated by one example. An educational resource on some major development issues can be created and made available around the world within a matter of hours. The technology is relatively mature but there are many organizational and economic issues that must be addressed before the full capabilities and value of this contribution to education is fully realized.

The effective utilization of a growing array of web-accessible resources to produce desired outcomes (effective and safe use of medical imaging technology) at the local level is enhanced by experienced medical physicists and institutional commitment and support for the higher levels of learning.

Web-based resources for physics and technology education, especially for radiology residents, fellows, and then practicing radiologists, should support a continuum of integrated learning activities and experiences that typically begin with formal classes. Supervised and mentored clinical activities are major applied physics learning activities where the online resources can be used under the guidance of the radiology and radiological physics faculty to demonstrate many concepts and applications. Preparation for board examinations provides a stimulus for reviewing previous study resources. Web-based resources are especially valuable for continuing education/lifelong learning activities and references for questions and issues that are encountered during a clinical career.

Several components and functions of the evolving educational system (classroom lectures, online modules, etc.) are analyzed with respect to their effectiveness and efficiency for meeting the educational needs of the medical imaging profession.

This course will be of value to all who are involved in medical physics and medical imaging education and who have an interest in the evolution of the process that is occurring now and leading into the future.

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Educational Objectives:

1. Identify and establish appropriate learning outcomes for specific medical professionals
2. Establish the types and levels of learning that will be required to produce the desired outcomes
3. Know the characteristics of learning activities that determine effectiveness
4. Analyze current or proposed learning activities with respect to efficiency
5. Understand the characteristics, especially effectiveness and efficiency, of the different models of educational activities
6. Identify the elements that contribute to an enriched learning environment
7. Plan and conduct educational activities that maximize effectiveness and efficiency
8. Develop learning facilitators (faculty) who can optimize their performance as medical physics educators
9. Use technology as an appropriate tool in the educational process.
10. Contribute experience and resources to the extended medical physics community through shared resources.