A Collaborative Model of Medical Physics Education Including Online Resources

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View this presentation at www.sprawls.org/ipad
Collaborative Teaching with Web-Based Resources

Addresses two of the major challenges of medical physics education:

Visualization

Interactivity with Feedback

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Collaborative Teaching with Web-Based Resources

Enhancing the performance of medical physics teachers

Enriches learning activities for students/residents

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Collaborative Teaching
with
Web-Based Resources

Example for Today
Medical Physics Education
for Image Quality Optimization
and
Dose Management in CT
(Around the World)
The Traditional Classroom

“ A Box for Enclosing Students...”

And hiding them from the world about which they should learning.
Rich Classroom and Conference Learning Activities

Learning Facilitator “Teacher”
- Organize and Guide the Learning Activity
- Share Experience and Knowledge
- Explain and Interpret What is Viewed
- Motivate and Engage Learners

Visuals
- Representations of Reality

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Teaching Physics Is Not
Learning Medical Physics is Building a Knowledge Structure in the Mind
The Elements of A Highly Effective Educational Session

The Brain

Connection

The Physical Universe (Physics of Medical Imaging)

Observe

Interact

Teacher / Guide

“Window”

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Teaching Medical Physics

“Window”

Provide Window
Guide the Learning Process

Teacher must

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A Traditional "Window" to the Physical Universe
The inverse square law is......

Twice the Distance

Photon Concentration (Exposure) decreased to 1/4th

X-ray beam now covers four times the area

The Inverse Square Law

\[ \frac{I_i}{I_f} = \left(\frac{d_i}{d_f}\right)^2 \]

\( I_i \) is the initial intensity of radiation, \( d_i \) is the initial distance, and \( d_f \) is the final distance, and \( I_f \) is the final intensity.
The Collaborative Teaching Model

Online Resources
- Modules
- Books
- Visuals

Enhance the performance of physics faculty

Knowledge Experience Guidance Role Model

Local Universities

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The Collaborative Teaching Model

Sprawls Online Resources
- Modules
- Books
- Visuals

Enhance the performance of physics faculty

Residents & Radiologists

Local Universities

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Collaborative Teaching is Sharing the Work

Resource Physicist

Create visuals and related resources
Share with the World

Local Physicist
Organizes
Guides
Shares Experience
Motivates
Role Model

Medical Physics Universe
Collaborative Teaching is
Sharing Experience, Perspectives, and Opportunities

Physicist

Radiologist

Clinical Applications

Radiology Residents

Principles and Concepts
Mammography Physics and Technology for effective clinical imaging
Perry Sprawls, Ph.D.

To step through module, [CLICK HERE.]

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Visuals to be used by Physicists in Classroom and Conference Discussions

SPRAWLS EDUCATIONAL FOUNDATION
Open Resources for Learning and Teaching
The Physical Principles of Medical Imaging

Computed Tomography Image Quality Optimization and Dose Management
Companion Module
http://www.sprawls.org/resources/CTIQDM/

Visuals for Classroom, Conference, and Collaborative Learning
RIGHT CLICK on each visual to download and use in PowerPoint or other display programs.

Computed Tomography
Image Characteristics
Radiation Dose

CT Image Characteristics
A
B
C
Reference
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CT Image Characteristics
Contrast
Detail
Noise

Objects in the Body
Physical Contrast
CONTRAST
SENSITIVITY
High
Medium
Low

Anatomical Detail
Image
Detail

# Modules for Self Study and Collaborative Learning in the Clinic

## Computed Tomography Image Quality Optimization and Dose Management

Perry Sprawls, Ph.D.

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Effective Medical Imaging Physics Learning...In The Clinic

The Real World Motivating Interactive Collaborative

The Physicist Provides: Learning Modules & Collaboration
Visuels for Learning and Teaching

The Imaging Process

Clinical Images

The Three Phases of CT Image Formation

Scan and Data Acquisition

Image Reconstruction

Digital/Analog Conversion and Display Control

Major Control Factors

KV
Pitch
Slice Th.
Matrix

MA
Beam Wid.
FOV

Time

Zoom

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Factors That Determine Image Noise

- **KV**
- **MA**
- **Time**
- **Pitch**

**Concentration** of Absorbed Photons and Energy at Each Location In the Body Tissue

**Filtered Back Projection**

**Digital Image**

**Voxel Size** Determines Number of Photons

- **Slice Th.**
- **FOV**
- **Matrix**
Relationship of **Radiation Dose** to **Image Detail**

**Lower Dose**

When detail is increased by
- Decreasing **Slice Th.**
- Increasing **Matrix**
- Decreasing **FOV**

**Noise Increases**

Because of decreased voxel size

**Higher Dose**

Dose must be increased to reduce noise.
CT Dose Quantities

Effective Dose

Factors

DLP

Scan Length

Pitch

CTDI weighted

CTDI volume
CT Slice Divided into Matrix of Voxels

Field Of View (mm)

Matrix Size (voxels/pixels)

Slice Thickness (mm)

Voxel Size Controlled By
CT Image Characteristics

Spatial

Detail

Artifacts

Noise

Contrast Sensitivity

Major Protocol Factors

KV
Pitch
Slice Th.
Window Width

MA
Beam Wid.
FOV
Window Level

Time
Filter
Matrix
Zoom

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The Values We Hold

The PHYSICIST is the TEACHER.

TECHNOLOGY is the TOOL that can be used for effective and efficient teaching.

Technology should be used to enhance human performance of both learners (residents, students, etc.) and teachers.
The Sprawls Resources

Sharing the Emory Experience with the World
With Emphasis on the Developing Countries

Emory

www.sprawls.org/resources

Open Access
Educational Resources

Global Impact

Visuals Books Modules

Enhancing Radiology Education in Every Country of the World
The Sprawls Resources
Users, April 2013

Global Impact
A Collaborative Model of Medical Physics Education Including Online Resources

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