Hands-on Physics Teaching of Radiology Residents

Jie Zhang, PhD, DABR
Associate Professor, Chief
Division of Medical Physics, Department of Radiology
University of Kentucky

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Teaching Radiology Residents: What, How, and Expectation

Teaching physics to radiology residents
- A Challenge

• Limited physics background
  — Most residents majored in Biology, Chemistry, etc.
• Lack of motivation
  — Learn sufficient physics to pass ABR exam
• Limited time
  — Many clinical demands on their time
**ABR exams**

- **Core Exam (Qualifying Exam):**
  - to validate if the candidate has acquired the knowledge, skills, and understanding basic to the entire field of diagnostic radiology, including physics.

- **Certifying Exam:**
  - to validate if the candidate has acquired and is able to apply the requisite knowledge, skills, and understanding that every practicing physician and radiologist should possess to begin independent practice.

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**“put into action”**

The ABR Examinations stress integration of physics into real-life clinical practice

- passive recall of facts (hearing, seeing)
- active applications of physics principles (acting)

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**ABR Goal**

Active application of physics principles

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Hearing  Seeing  Interactive

Didactic Lecture  Observation

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**“Put into action”**

"Put into action"
不闻不若闻之，闻之不若见之，见之不若知之，知之不若行之；学至于行之而止矣。

——荀子, Xunzi, a 3rd century BC philosopher and teacher

I hear and I forget.
I see and I remember.
I do and I understand.

true learning continues until it is put into action

A “hands-on” approach to teach physics

• Engages the learners, viewed as eminently practical
• Provides “Psychological intervention”
  – Convert a negative interpretation into a positive or neutral interpretation that leads to greater success and a sense of belonging in the classroom

Physics hands-on rotation

• One-week physics rotation for first year residents before didactic physics lectures
• 7 Modules

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Curriculum for hands-on physics education

- X-ray tube component, output and heel effect
- Effects of imaging acquisition i.e., kV, mAs, focal spot size, SID, field of view, on image quality and radiation dose
- Appropriate use of AEC
- Fluoroscopy and CT dose metrics and measurements
- Strategies to reduce patient and personnel dose
- Tube current modulation and auto kV
- Ultrasound image creation and Doppler
- T1, T2, FID, MRI scanner component, MRI safety
- Dose calibrator and radiation survey, gamma camera and SPECT
- PET principle
Measuring projected focal spot size variation on image quality

Measuring CTDI

Experiencing force on metal
Feeling eddy current

Assessing safety of implants

Summary

- Covers basic physics concepts, specifically targeting their clinical uses through interactive practice.
- Makes theoretical physics concepts “real”.
- Prepares residents for deep understanding of physics from didactic lectures.
 Residents’ feedback

I was surprised by how applicable the understanding of physics is to the diagnostic radiologist’s daily practice.

It has given me, in addition to the basic concepts I will encounter along the first year. It gives me a good foundation to later learn more about the complicated job of reading my physician’s knowledge every time. Rather than just viewing it as another part of the exam, I think it helped me see how without it we can be a nothing radiologist.

Lessons Learned

• Be prepared
  – Practice before hands-on rotation
  – Ensure scanner availability

Next step

• Solicit feedback from radiologists, technologists, residents, colleagues
• Evaluate outcome of hands-on physics training
  – ABR Core Exam: Physics score
  – Radiologists’ observation during clinical rotations