

Investigating students' Ideas
About X-rays While
Developing Teaching
Materials for a Medical
Physics Course

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Modern Miracle Medical Machines

goals

- Conduct research on the models that students use in the medicine-related physics topics
- Develop active engagement teaching materials to help students learn about the application of modern physics to contemporary medicine

Motivation to study students' models of X-rays

- Students already have some models of X-rays for which they used pieces of knowledge transferred from different sources:
 - Their own experience
 - Various non-organized sources (mass media etc.)
 - Previous Physics (or other Science) classes
- These models:
 - Shouldn't be ignored
 - Can be studied

Investigating students' models

series of interviews – Spring 2006

Two stages:

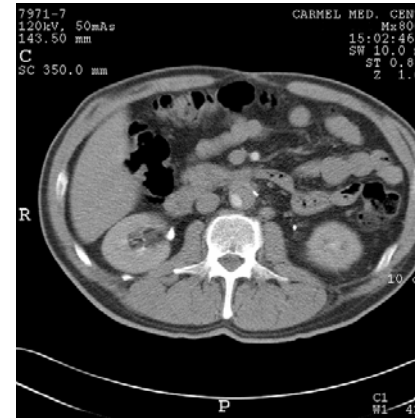
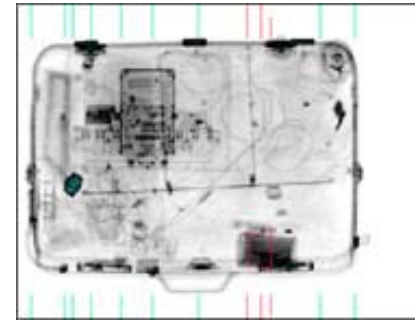
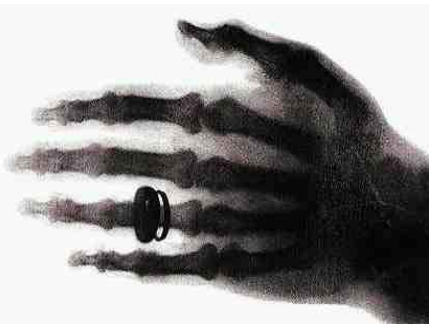
1. Clinical interview
2. Teaching interview

13 General (Algebra-based) Physics students
(6 GP1+7 GP2):

1. 6 pre-meds (3 GP1 + 3GP2)
2. 5 other health-related majors (2 GP1 + 3 GP2)
3. 2 engineering majors (1GP1 + 1GP2)

Starting the interview identifying familiarity with X-rays

- Have you seen such pictures? Can you group them?



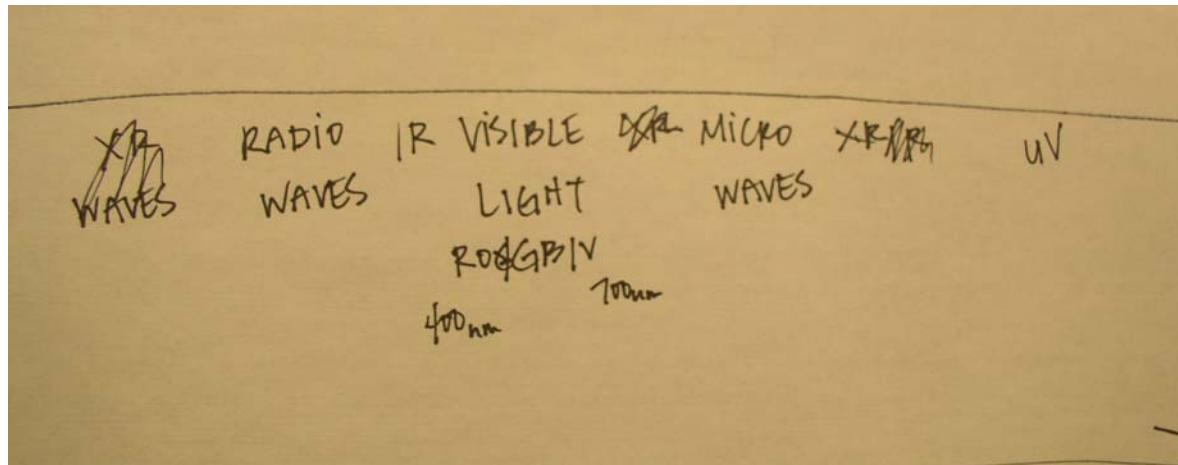
Clinical Interview

a part of the protocol

- How do X-rays interact with our body parts?
- What other thing are similar to X-rays?
- How X-rays are different from ultrasound?
- What makes things visible to X-rays?
- How would you explain X-rays to a 12-year old child (if differently)?
- What can you tell about other medical imaging techniques?
- General discussion

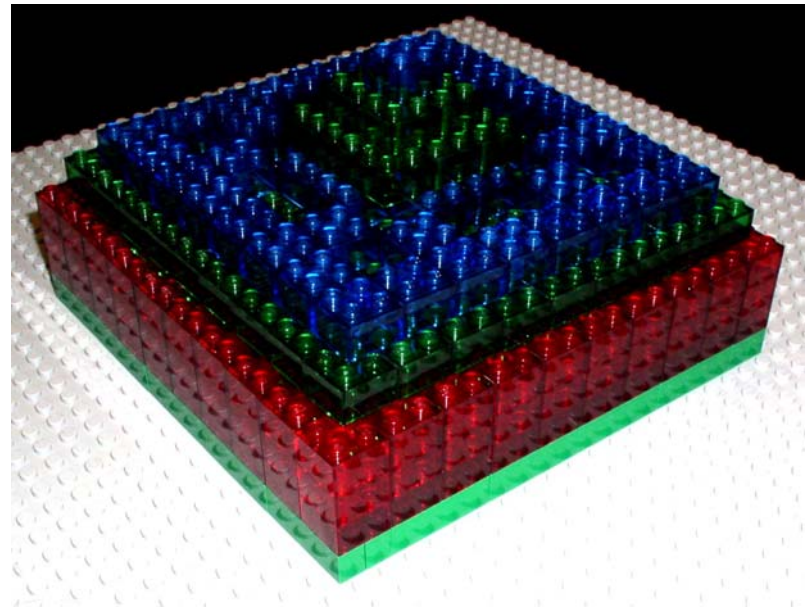
Some of the results of the clinical interviews

- Students strongly associate **X-ray visibility** with **density**
- The majority of them know that X-rays are a part of the light spectrum but often don't place them properly



Teaching Interview

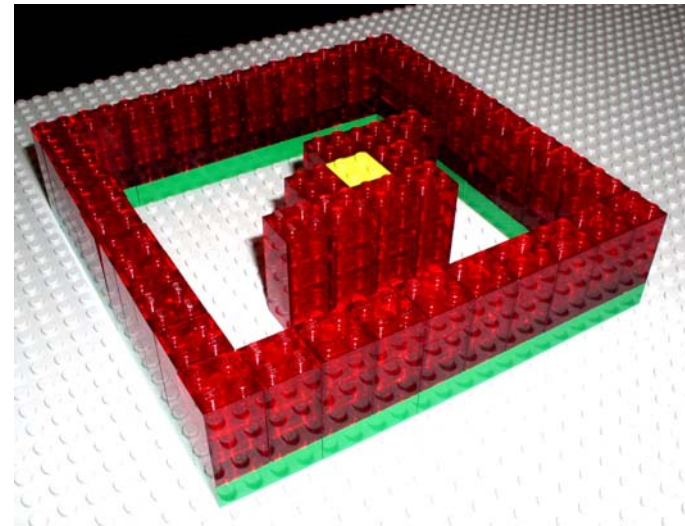
- Refreshing the previous discussion
 - X-rays are a part of the light spectrum
- Presenting a semitransparent Lego model of X-rays / CAT scan
- *“How can we figure out what’s inside?”*



Teaching Interview



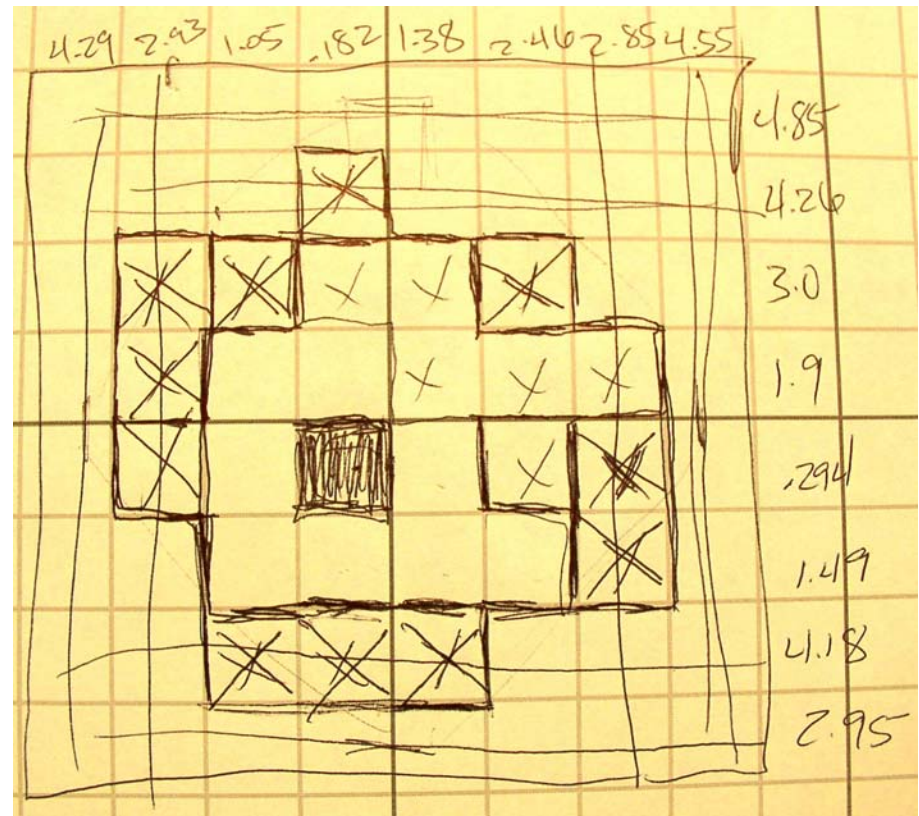
- “What kind of equipment do we need?”
- Presenting a light source and a light receiver
- Showing a similar open Lego box



Teaching Interview



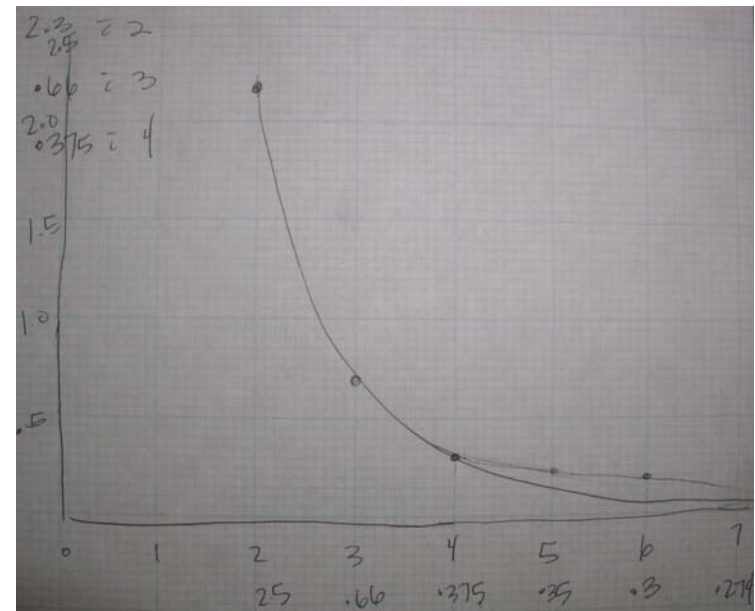
- Going around the box and writing down the readings
- Making predictions about the shape
- *“How the readings of the light receiver depend on the number of bricks?”*



Teaching Interview

IV

- Focusing on a single row
- Adding bricks one by one
- Making and testing predictions



Teaching Interview



-
- Making the final prediction and opening the closed box
 - Discussing the discrepancies
 - What are the sources of errors?
 - **General Discussion**
 - How helpful was the activity as the whole?
 - How useful were different parts of it?
 - Limitations of the model
 - What kind of changes would you propose?

Some Results of the Teaching Interview

- We noticed numerous evidences of transfer of learning both between students' previous experience and our interviews and between the clinical and the teaching interview stages.
- Students successfully invoke their optical knowledge that helps them learn how not **local** (mass) **density** but other **integral** characteristics determine visibility of the hidden object by X-rays and CAT scans

Thank you!

Modern Miracle Medical Machines website

<http://web.phys.ksu.edu/mmmm/>

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