DEVELOPING EFFECTIVE MEDICAL PHYSICS KNOWLEDGE STRUCTURES

MODELS and METHODS

Project CONET
A Resource for
Medical Physics Educators

Perry Sprawls, Ph. D.
Department of Radiology and Imaging Sciences
Emory University
&
Sprawls Educational Foundation
www.sprawls.org

This presentation can be viewed at

www.sprawls.org/ipad

Medical Physics Knowledge Structures

Medical Imaging Physics Universe

Learn

Observe

Interact

Sensory Concepts

Apply

Analyze

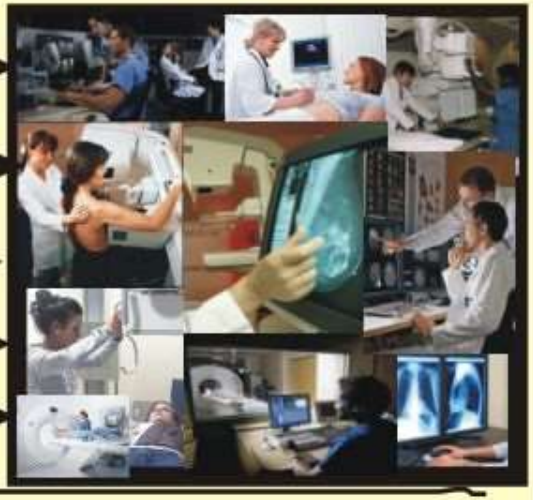
Evaluate

Change

Create

Teach

Medical Imaging Physics Universe



Classroom

Symbols

Mathematical

$$k = \lambda / 2\pi$$

$$\alpha_{hh} = \frac{\varepsilon - 1}{\left(\cos\theta + \sqrt{\varepsilon - \sin^2\theta}\right)^2}$$

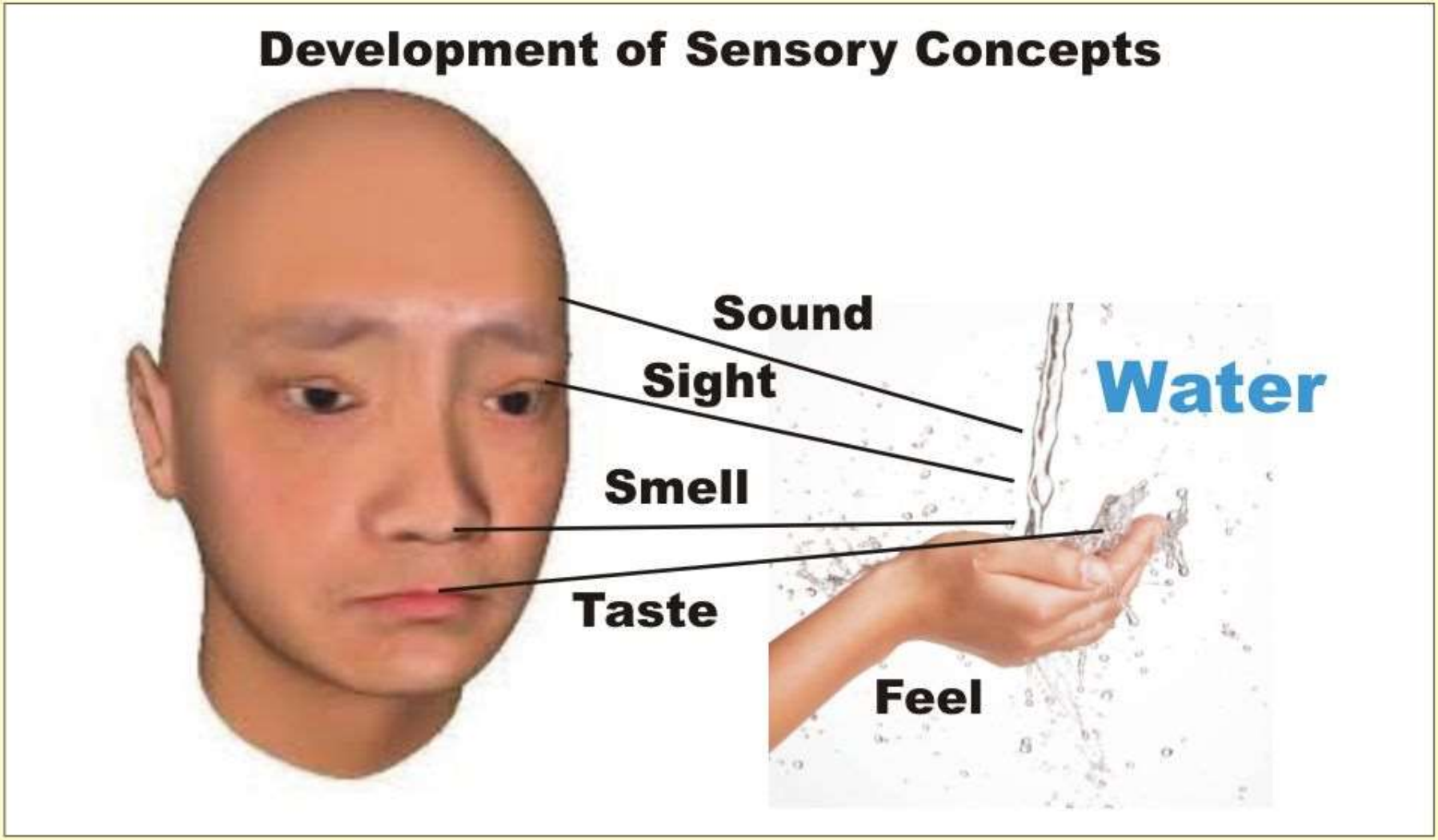
$$\alpha_{vv} = \frac{(\varepsilon - 1)\left(\varepsilon + \varepsilon\sin^2\theta - \sin^2\theta\right)}{\left(\varepsilon\cos\theta + \sqrt{\varepsilon - \sin^2\theta}\right)^2}$$

Verbal

Descriptions & Definitions

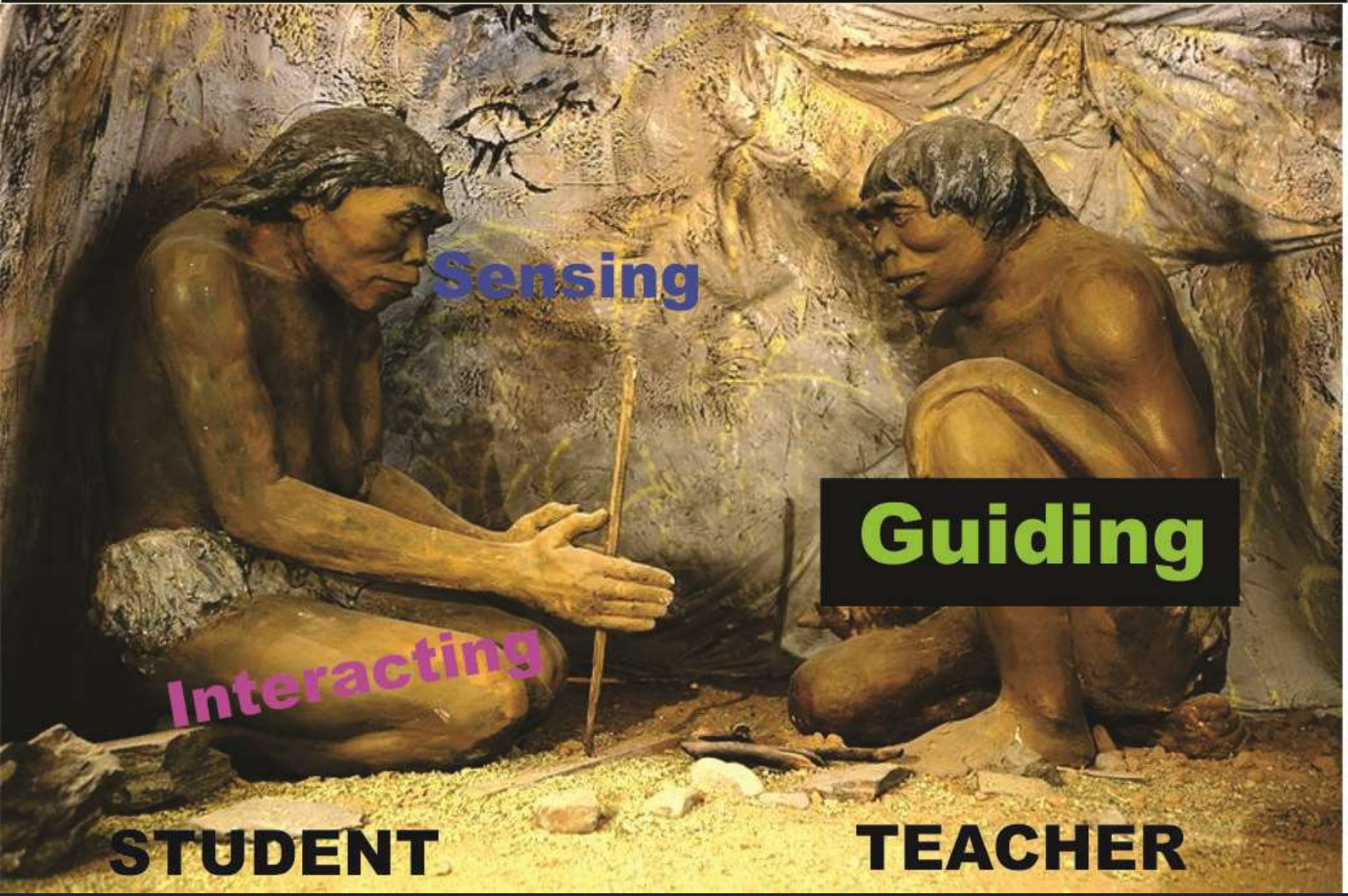
Exams

Natural Learning of Physics



By Sensing and Interaction

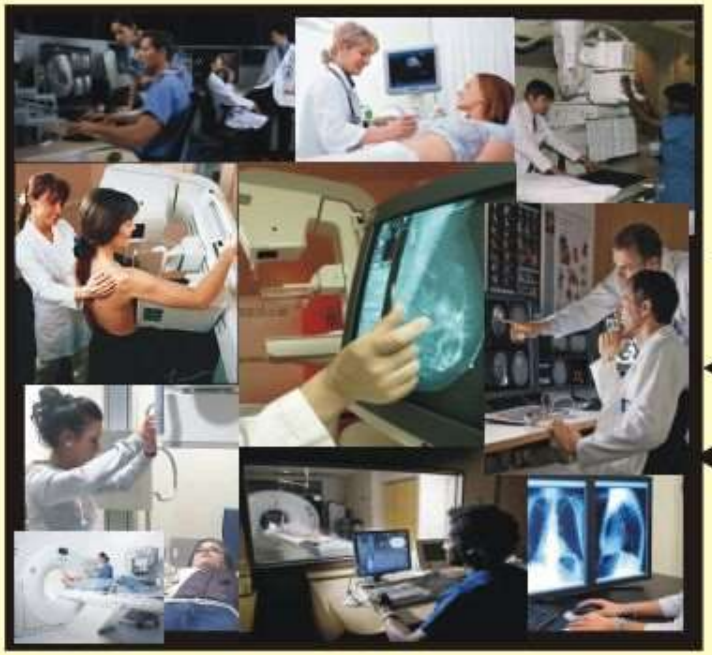
Highly Effective Physics Lesson



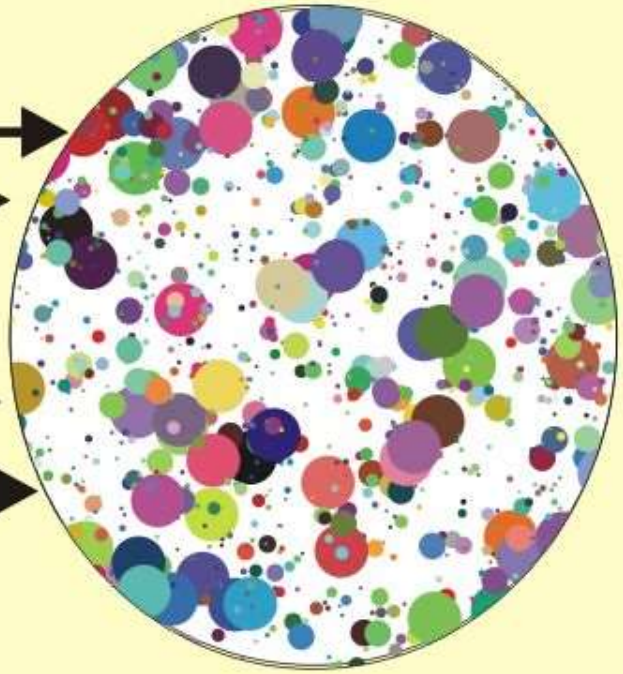
Medical Physics Knowledge

Development and Application

Medical Imaging Physics Universe

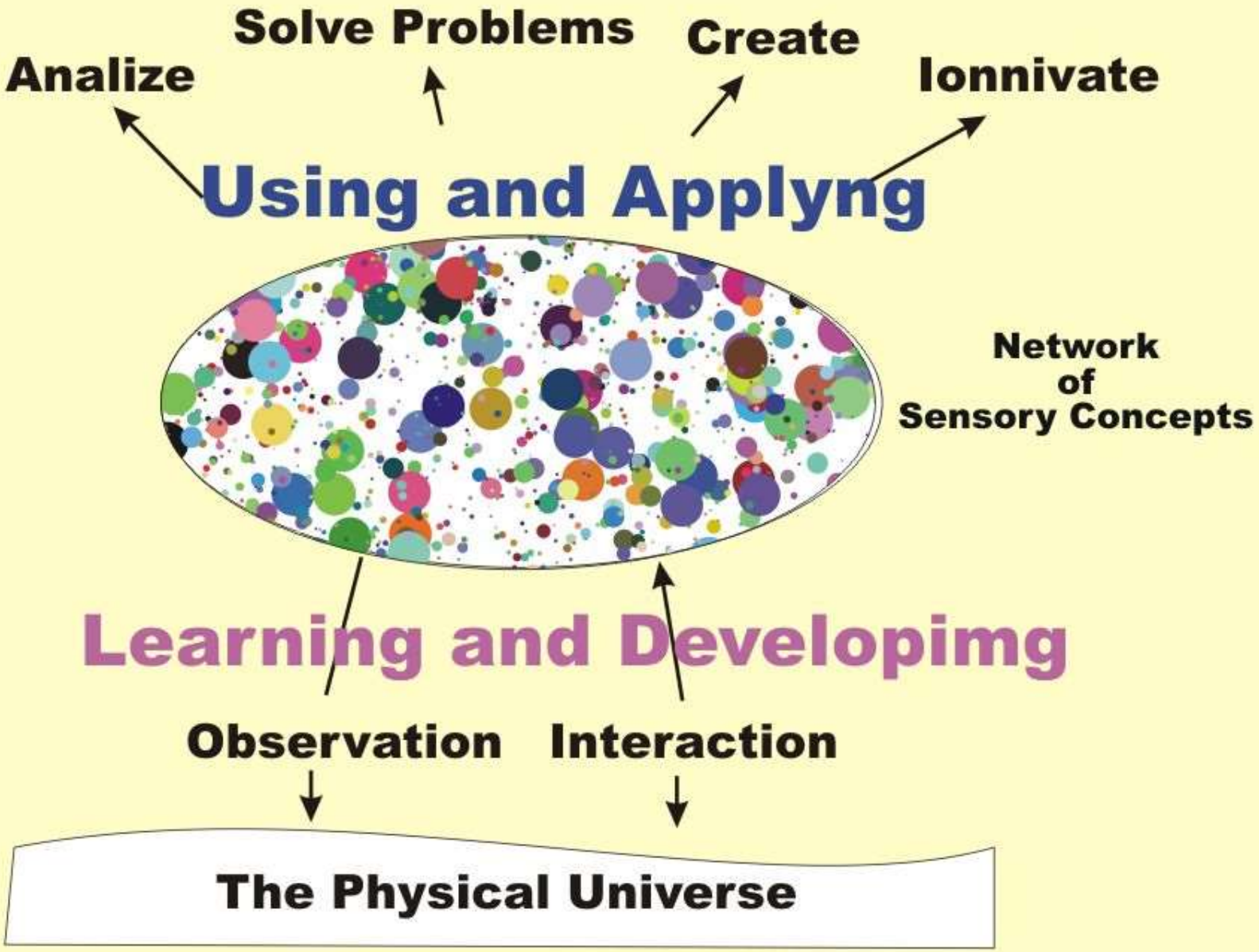


In The Mind

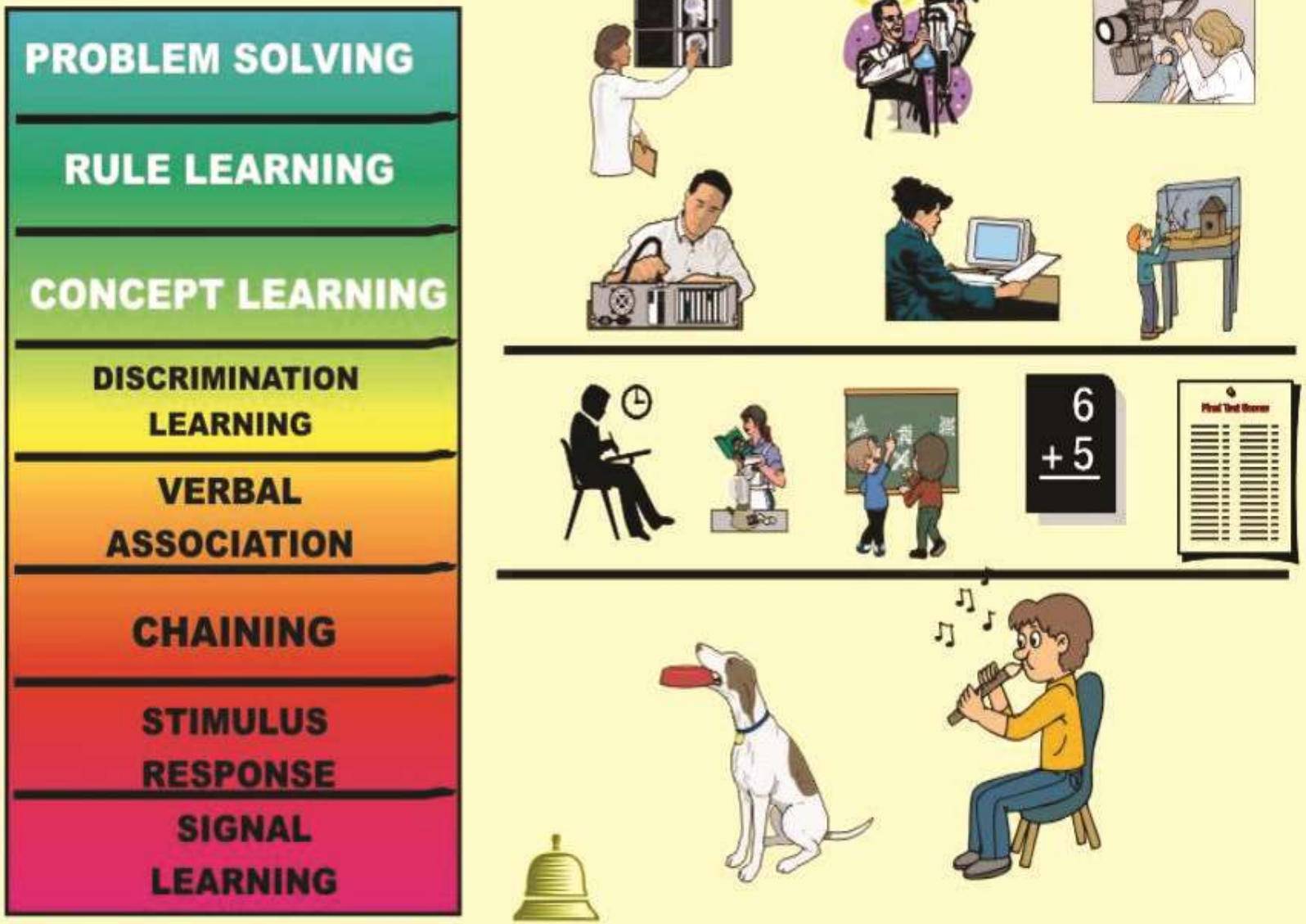


A Network of Sensory Concepts

Medical Physics Knowledge



Gagne's Hierarchy of Learning



PHYSICS KNOWLEDGE STRUCTURES

Visual Feel Sound Taste Smell

Words Math Symbols

Sensory

Symbolic

Concepts

Facts, Definitions, Descriptions

Building Knowledge Structures

Levels

Learning

Applying

Development of Sensory Concept Networks

Clinical Medical Physics

PROBLEM SOLVING

RULE LEARNING

CONCEPT LEARNING

DISCRIMINATION LEARNING

VERBAL ASSOCIATION

CHAINING

STIMULUS RESPONSE

SIGNAL LEARNING

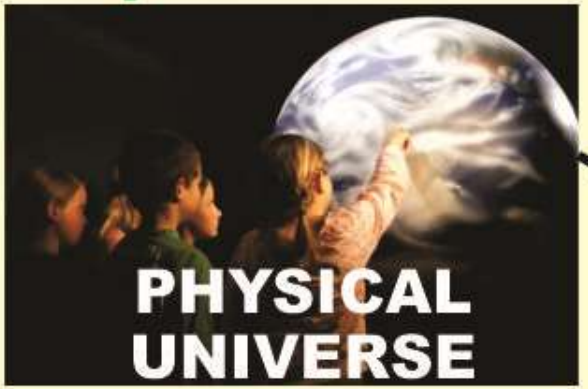
Linear Lectures & Text

Traditional Examinations

Sprawls

Sensory Concept Networks

Mental Representation



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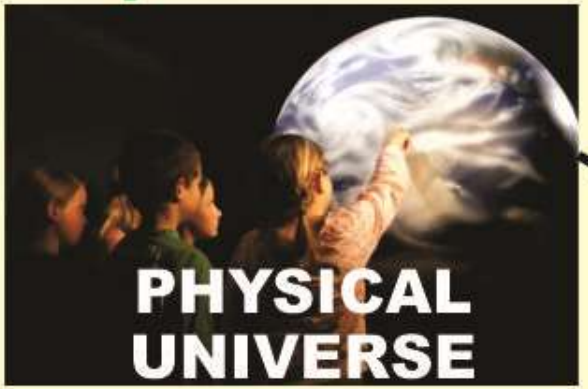
Sensory Concept Networks

Mental Representation

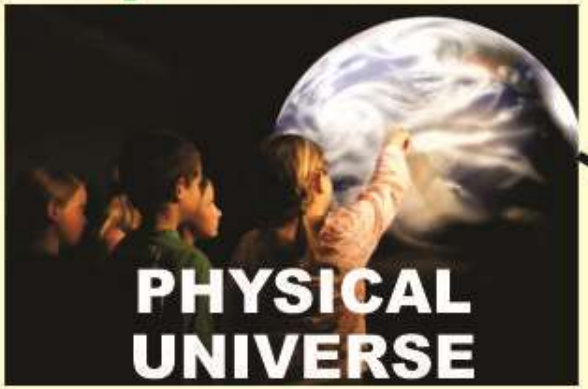


Natural Learning

Sprawls

Sensory Concept Networks

Mental Representation



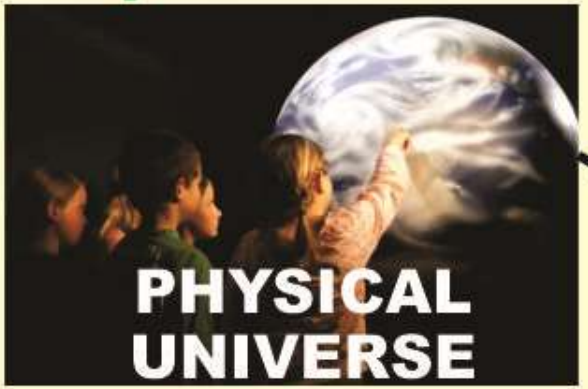
Natural Learning

Highly Effective

Sprawls

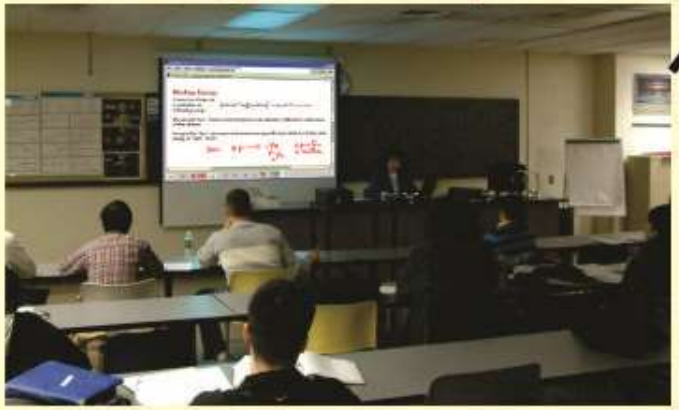
Sensory Concept Networks

Mental Representation



Natural Learning

CHALLENGE TO HELP DEVELOP (TEACH)



Highly Effective

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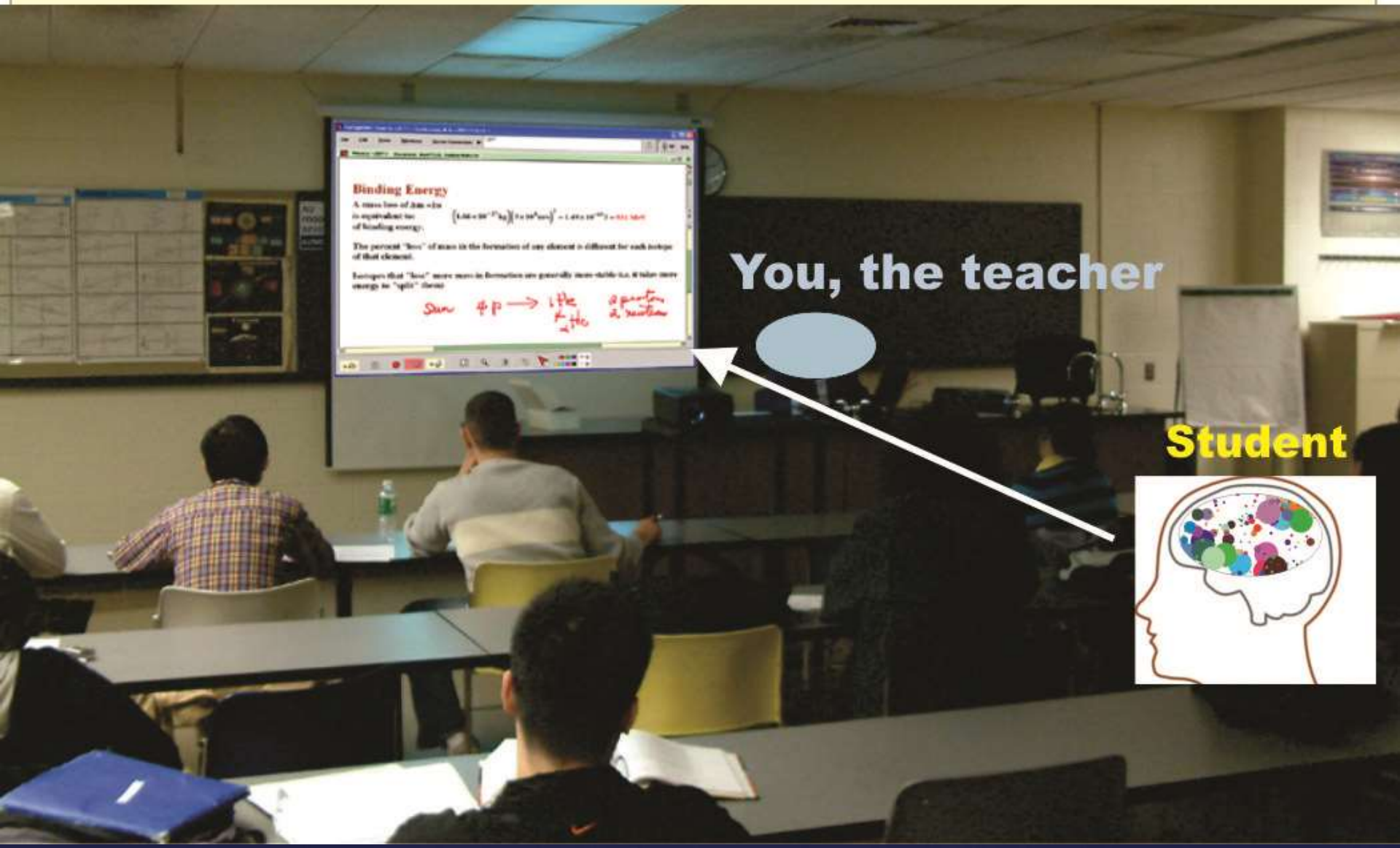
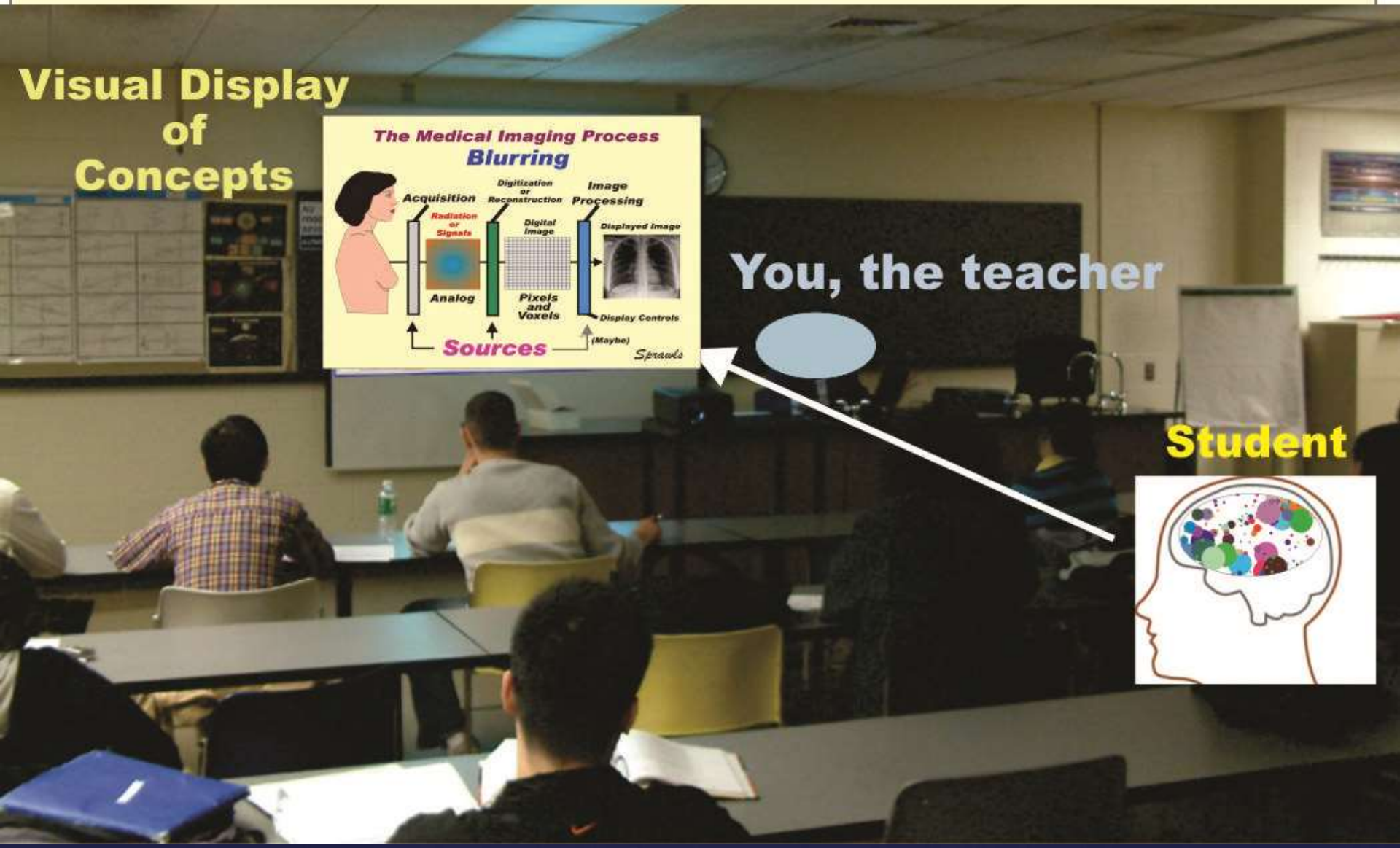
Sensory Concept Networks

THE CHALLENGE, TO HELP DEVELOP (TEACH)



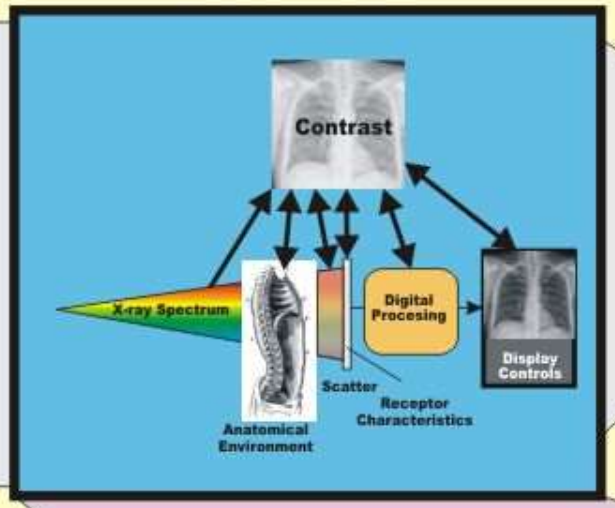
Sensory Concept Networks

THE SOLUTION, TO HELP DEVELOP (TEACH)

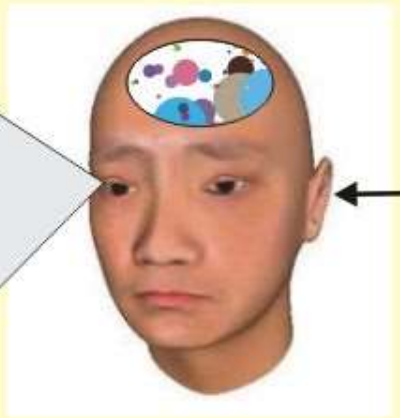


Medical Imaging Physics Universe

CONET



Learner



Guidance
Knowledge
Experience
Organization
Motivation

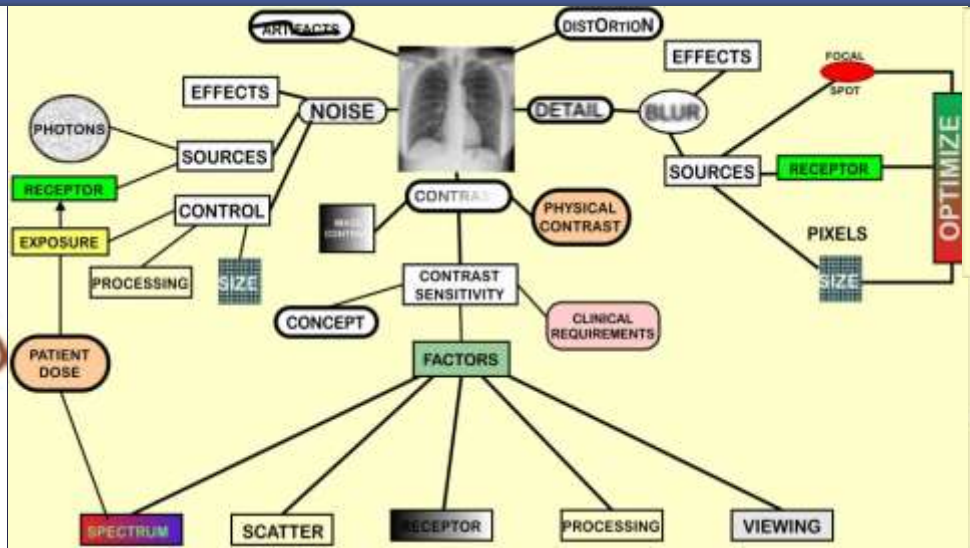
Provides

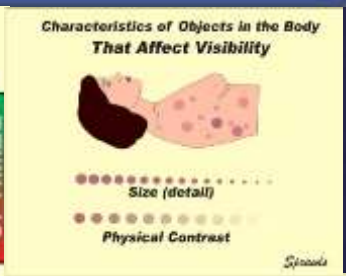
Medical Physics Educator

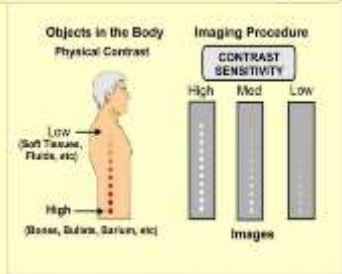
CONCEPT NETWORK DEVELOPER

A comprehensive collection of visual resources to be used by Medical Physics Educators in helping Medical Physics Learners develop highly effective knowledge structures.

Provided with open and free access by the
Sprawls Educational Foundation
www.sprawls.org/CONET







Project CONET
(Concept Network Developer)

Elements

Modeling of medical physics knowledge structures.

Association of structural elements with task or functions to be performed.

The educational process for developing effective knowledge structures.

Tutorials for medical physics educators on the concepts development of effective knowledge.

An open and shared resource (CONET) that can be used by medical physics educators around the world.

Distribution of the CONET resource both within the AAPM and around the world..

Project CONET
(Concept Network Developer)

Value and Expected Outcomes

A better understanding of physics knowledge structures for medical physics educators.

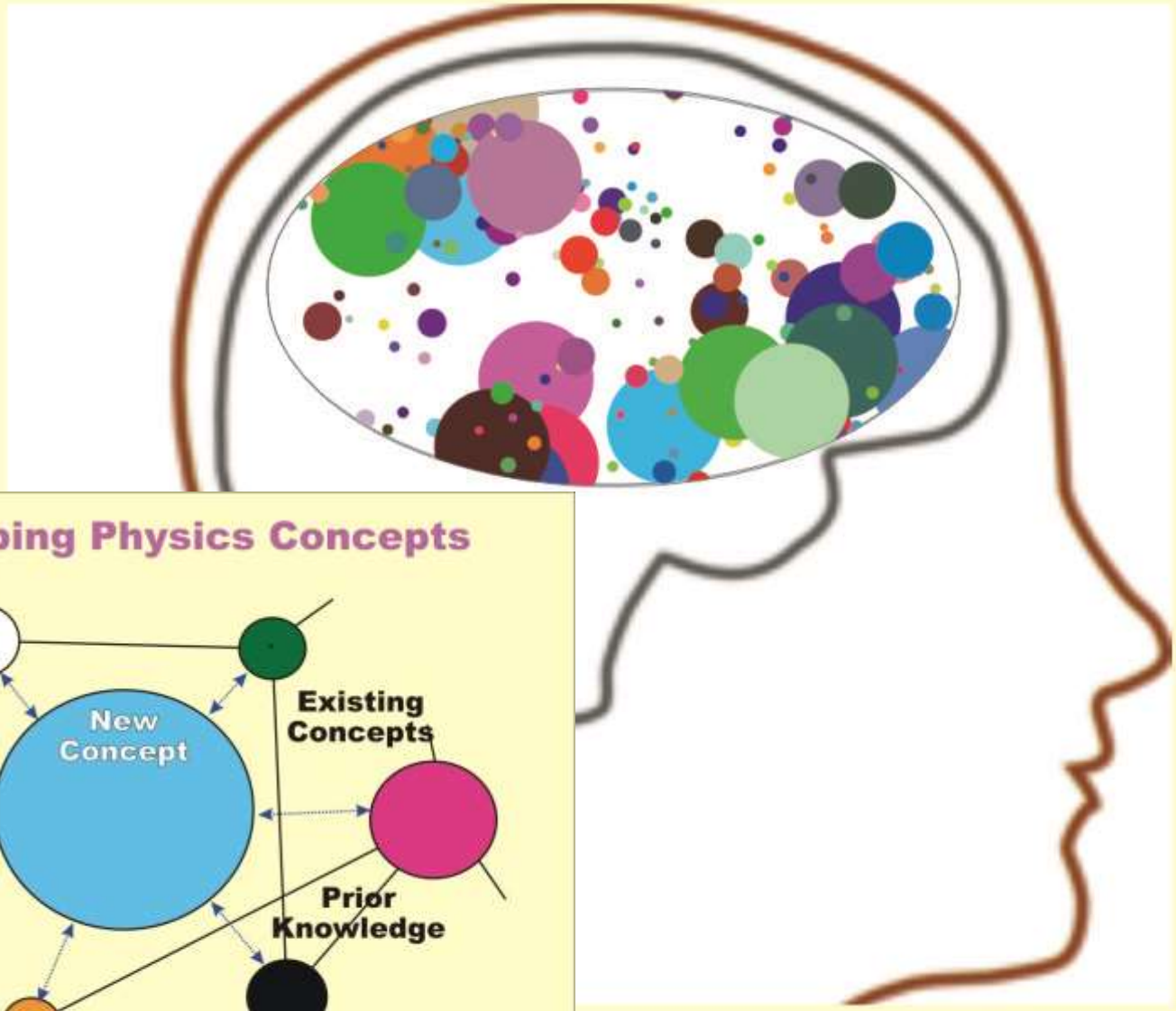
An enhancement to traditional medical physics educational programs.

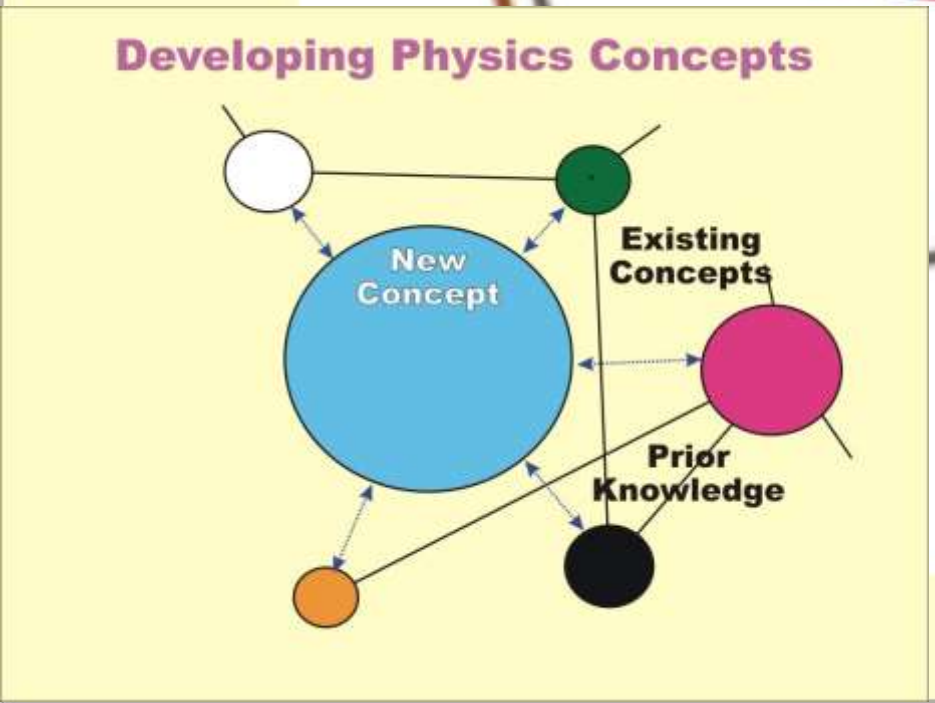
Provide medical physics educators with opportunities to function at a higher professional level by sharing knowledge and experience.

Increased understanding of physics concepts (sensory, not symbolic).

Provides for increased interactivity between educators and learners.

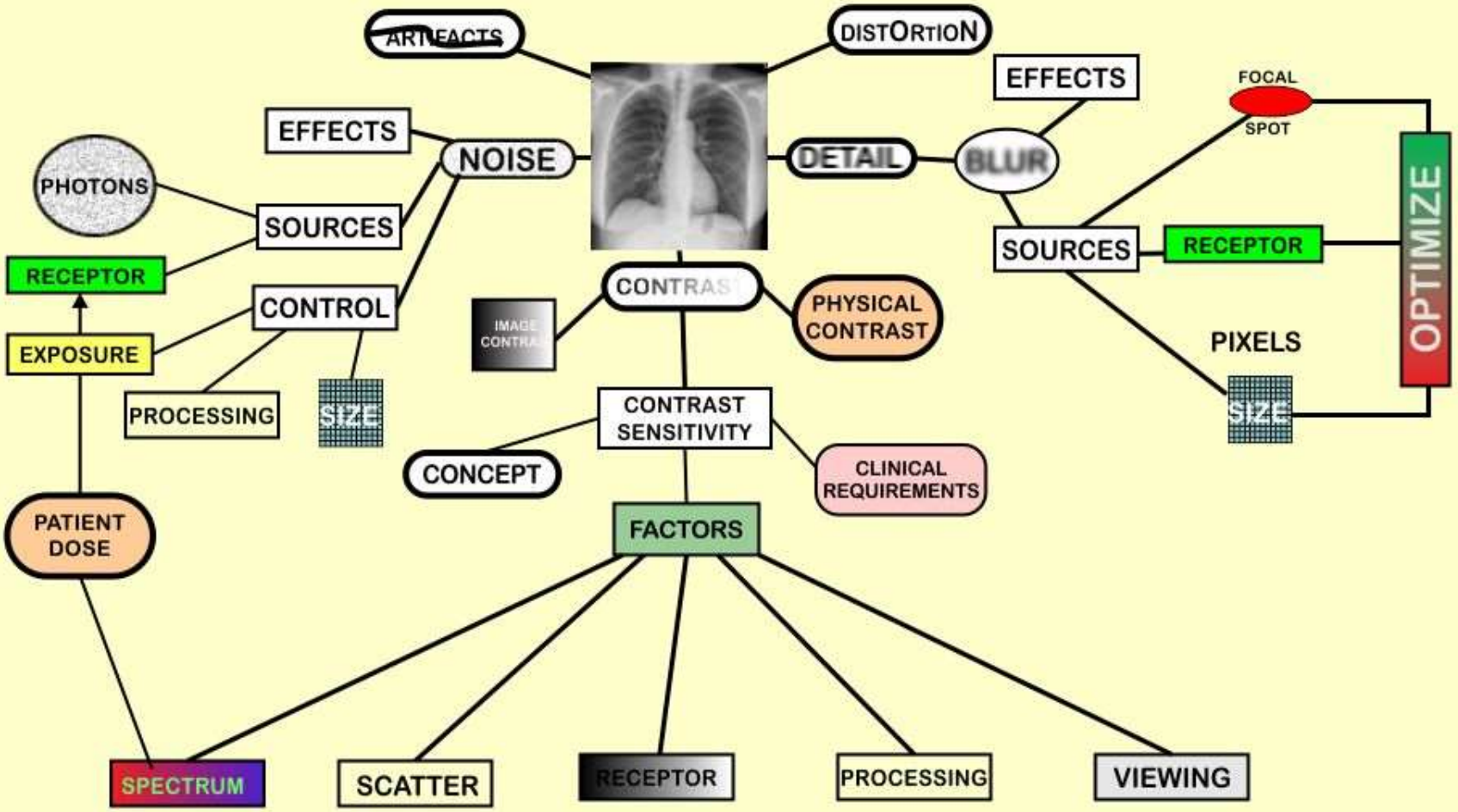
Sensory Concept Networks





Sprawls

RADIOGRAPHIC IMAGE QUALITY
Visual Concepts for Effective Clinical Application



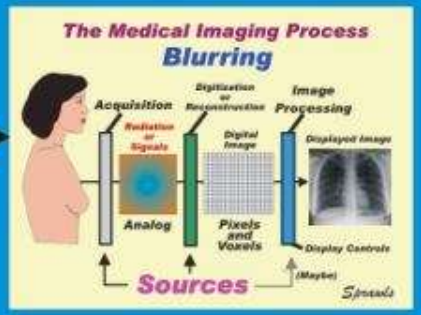
Sprawls

Project CONET

Who will benefit from an enhanced sensory conceptual knowledge of medical physics?

MEDICAL PHYSICS STUDENTS

Understanding



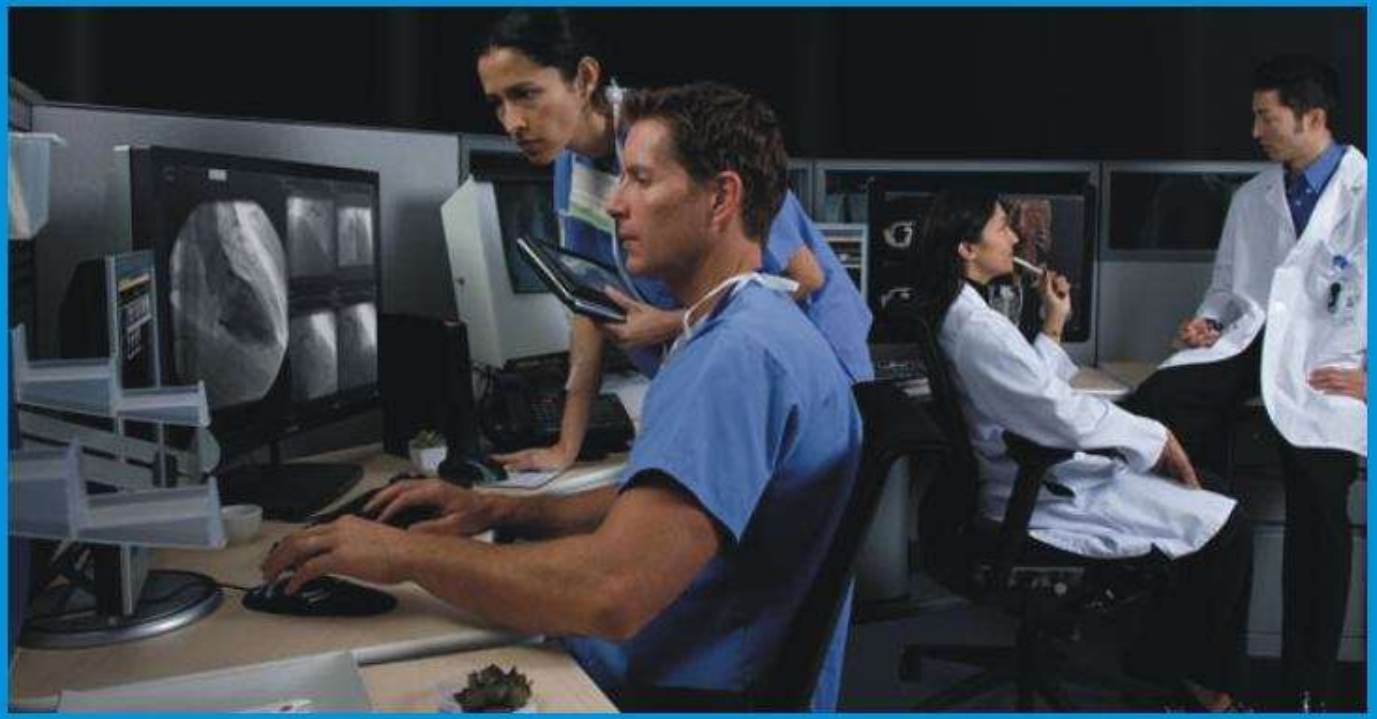
Foundation for

Symbolic

Project CONET

Who will benefit from an enhanced sensory conceptual knowledge of medical physics?

RADIOLOGISTS & RESIDENTS



Project CONET

Who will benefit from an enhanced sensory conceptual knowledge of medical physics?

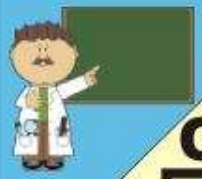
RADIOGRAPHERS & STUDENTS

FUTURE

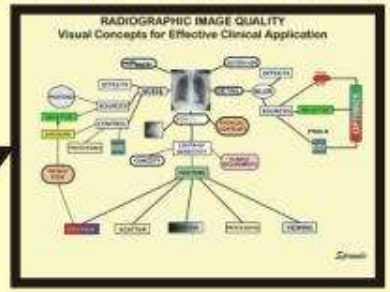
Expanding Topics

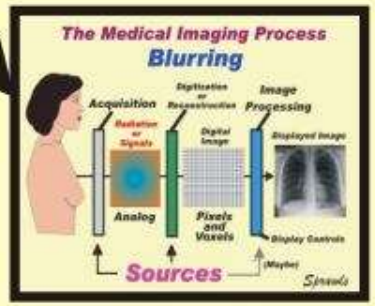
Available with Open Access

Enhanced



On The Web





100 + Concept Images Developed

NOW

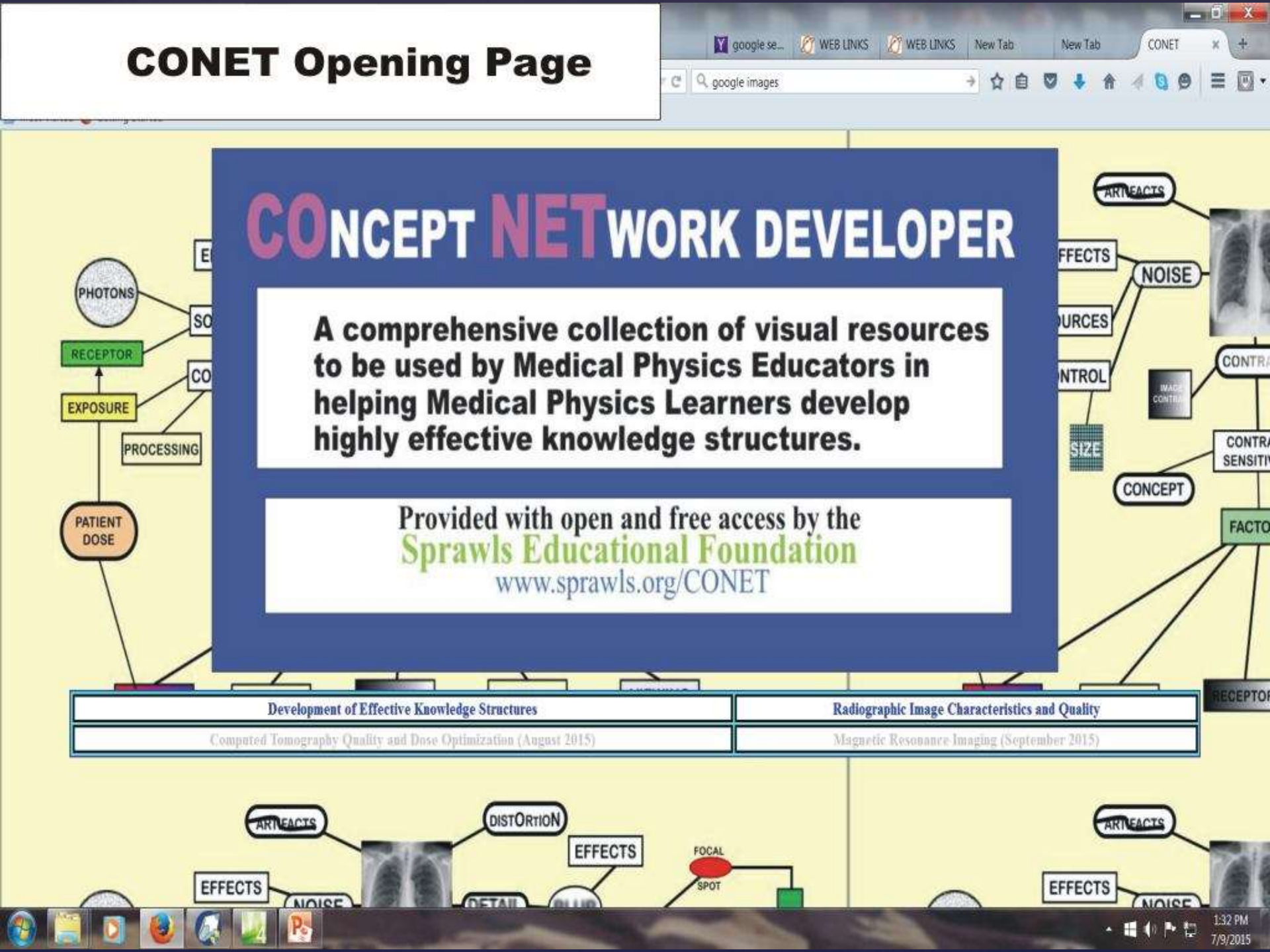
Project CONET

Extensive Experience In:

- Medical Physics Teaching
- Material and Media Development
- Program Development & Direction
- The Science of Learning and Teaching
- Faculty Development

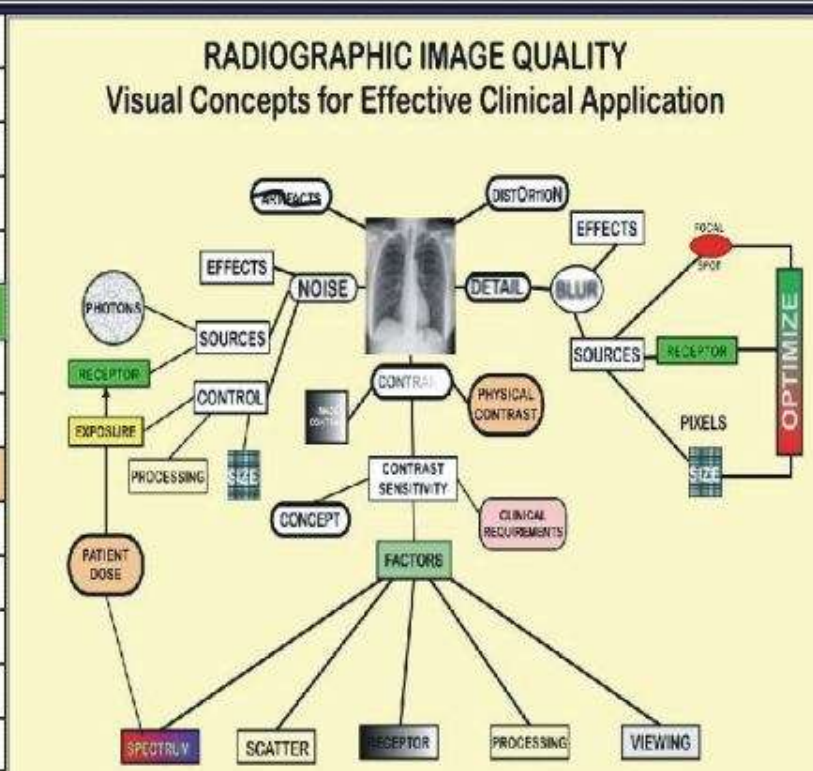
BACKGROUND and FOUNDATION

CONET Opening Page



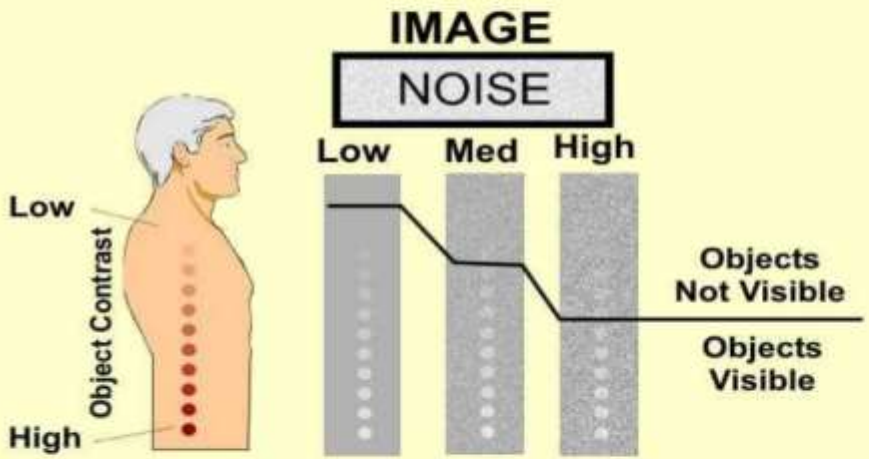
Radiographic Image Quality
Opening Screen

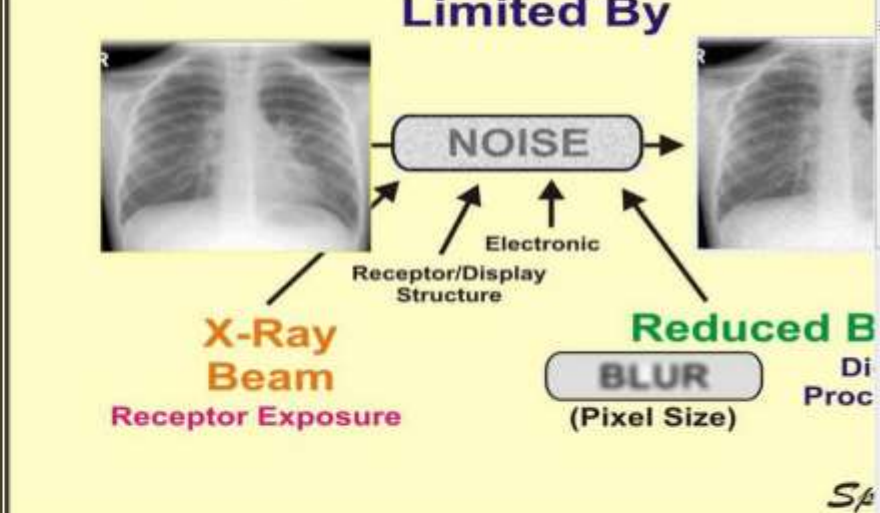
- ARTIFACTS
- CONCEPT of NOISE
- EFFECTS of NOISE
- SOURCES of NOISE
- CONTROLLING NOISE
- RECEPTOR EXPOSURE
- PROCESSING
- DIGITAL PIXEL SIZE
- PATIENT DOSE
- EFFECTS of SPECTRUM
- RELATION to NOISE



- DISTORTION
- DETAIL and BLUR
- EFFECTS of BLUR
- SOURCES of BLUR
- FOCAL SPOT
- RECEPTOR
- DIGITAL PIXEL SIZE
- OPTIMIZATION
- PHYSICAL CONTRAST
- IMAGE CONTRAST
- CONTRAST SENSITIVITY CONCEPT
- CLINICAL REQUIREMENTS
- SPECTRUM
- SCATTER
- RECEPTOR
- PROCESING
- VIEWING

NOISE SOURCES IN RADIOGRAPHY



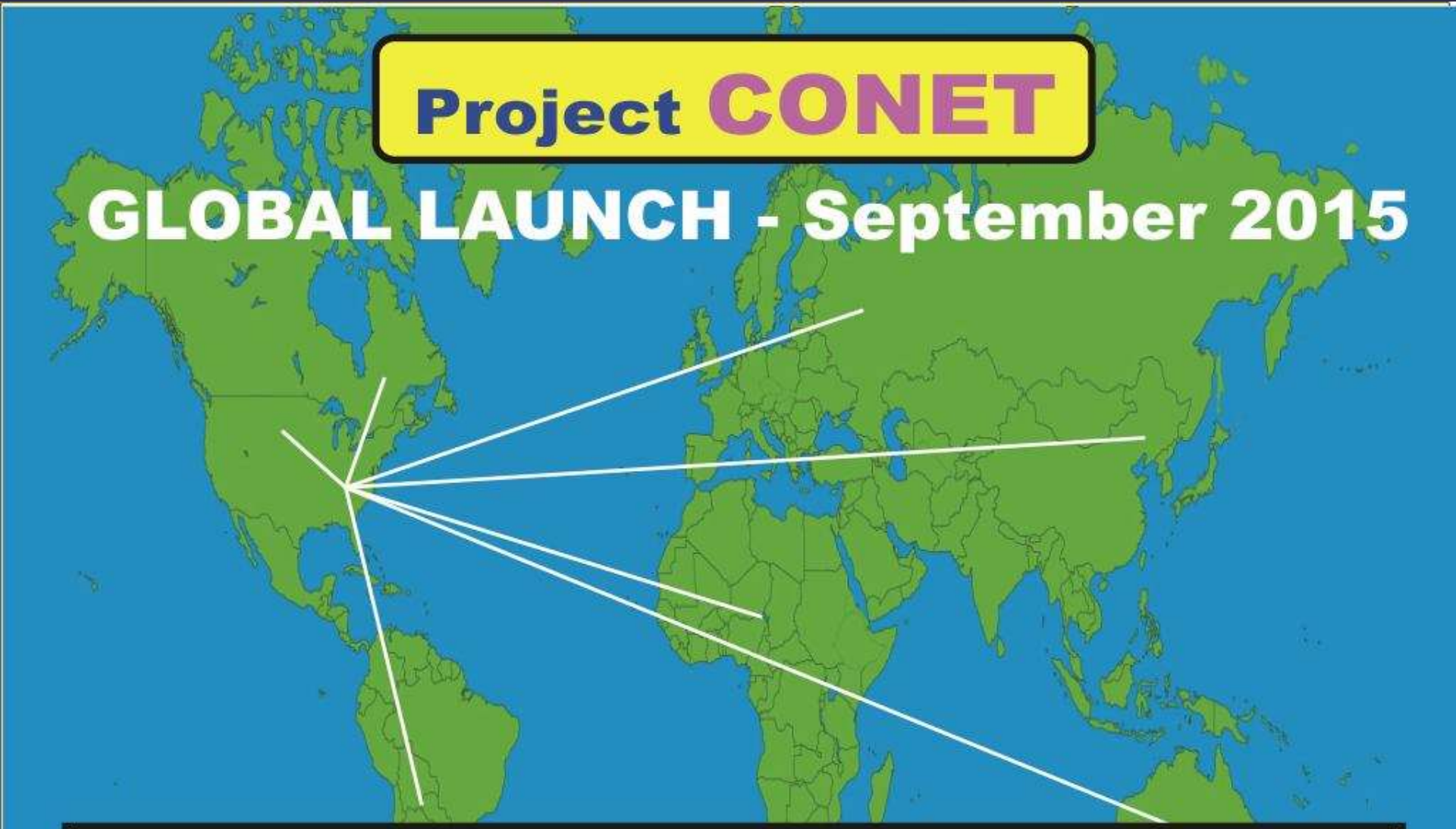


X-Ray Image Noise

X-Ray Image Noise

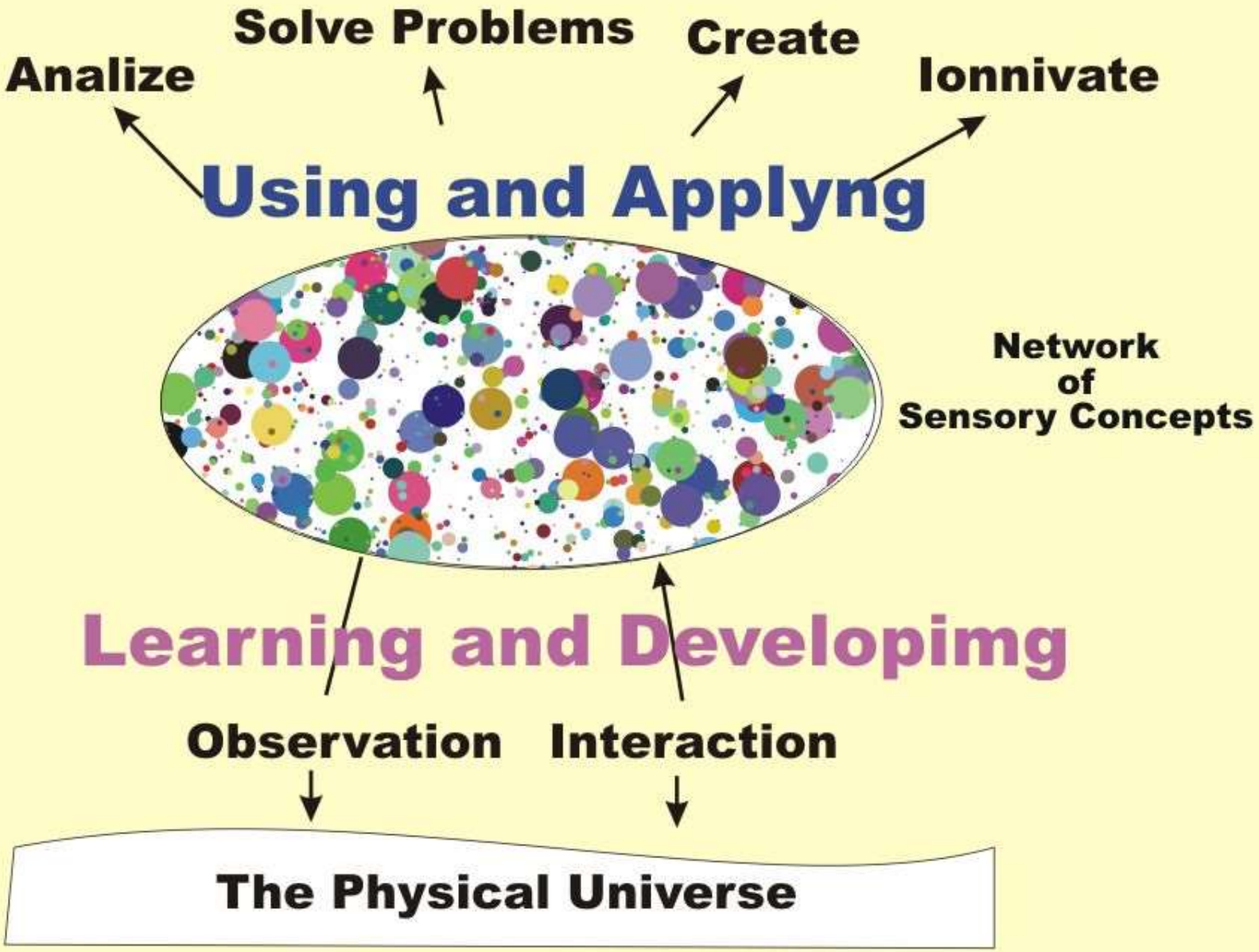
Project CONET

GLOBAL LAUNCH - September 2015



Publication in *Medical Physic International Journal* (IOMP)
Add to *Sprawls Resources* Website (Now used in 50+ Countries)
Add to AAPM Educators Resource Guide
This will be followed by additional publications & presentations.

Medical Physics Knowledge



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