

NSF WORKSHOP

Development and Application of Online Medical Imaging Education

Sponsored by NSF Grant DUE1022750
Principal Investigator: Weizhao Zhao, Ph.D.

College of Engineering, University of Miami
1251 Memorial Drive, Coral Gables, FL 33146

August 16th, 2013

NSF 1022750 National Workshop

McArthur-Annex Building, Room 202
College of Engineering, University of Miami
1251 Memorial Drive, Coral Gables, FL 33146

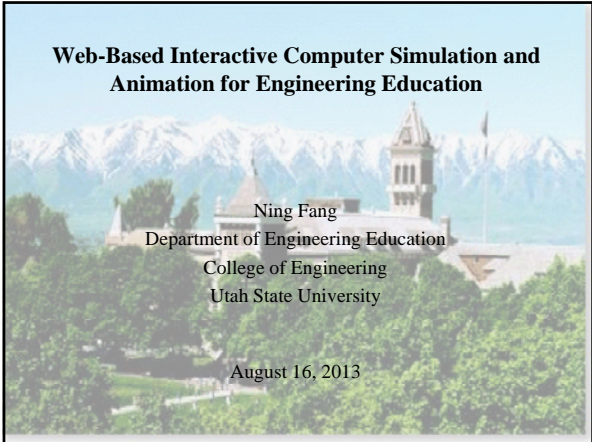
August 16th, 2013 (8:30 am – 5:00 pm)

Final Program

- | | |
|----------|--|
| 8:00am | Breakfast |
| 8:30 am | Registration, Introduction, Picture |
| 9:00 am | Invited Presentation: Web-Based Interactive Computer Simulation and Animation for Engineering Education, Ning Fang, Utah State University |
| 9:30 am | Medical Imaging Education by Online Animation and Simulation, Weizhao Zhao, University of Miami |
| 10:00 am | Medical Imaging Teaching Software: Ultrasound Imaging and Image Processing, Ricardo Castellanos, Diego Pava, Nurgun Erdol and William Rhodes, Florida Atlantic University |
| 10:20 am | Web Based Interactive Medical Imaging Application for Teaching Nuclear Medicine, Senait Debebe, Ruchir Bhatt, and Anthony McGoron, Florida International University |
| 10:40 am | Evaluation STEM Initiatives, Ann Bessell, University of Miami |
| 11:00 am | Discussion in THREE groups lead by PIs of FAU, FIU and UM, scribed by one participating scholar: Current medical imaging curriculum, teaching strategies, resources, and plans |
| 12:15 pm | Summary presentation of each group presented by a participating scholar |
| 12:30 pm | Lunch break |
| 1:30 pm | Tutorial for the developed MITS/DATS system |
| 5:00 pm | Conclusion |

Table of Contents

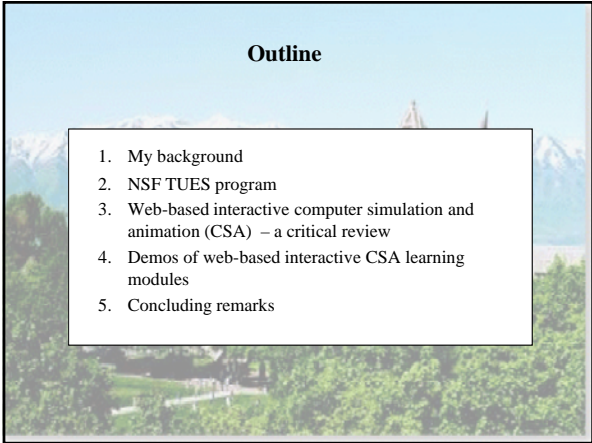
		Page
1	Invited Presentation: Web-Based Interactive Computer Simulation and Animation for Engineering Education, Ning Fang, Utah State University	1
2	Medical Imaging Education by Online Animation and Simulation, Weizhao Zhao, University of Miami	15
3	Medical Imaging Teaching Software: Ultrasound Imaging and Image Processing, Ricardo Castellanos, Diego Pava, Nurgun Erdol and William Rhodes, Florida Atlantic University	30
4	Web Based Interactive Medical Imaging Application for Teaching Nuclear Medicine, Senait Debebe, Ruchir Bhatt, and Anthony McGoron, Florida International University	33
5	Evaluation STEM Initiatives, Ann Bessell, University of Miami	37
6	Tutorial for the developed MITS/DATS system	45
7	MITS/DATS User Manual	72



Web-Based Interactive Computer Simulation and Animation for Engineering Education

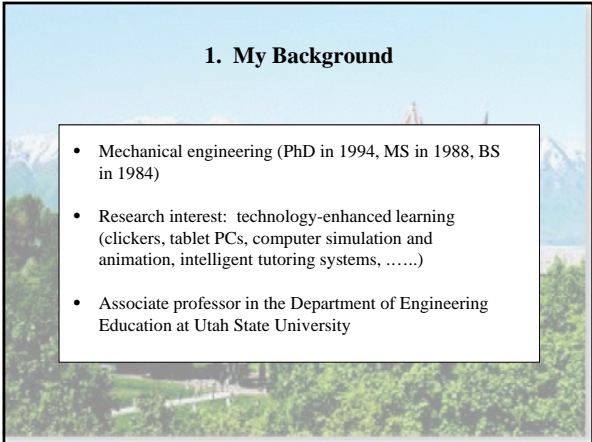
Ning Fang
Department of Engineering Education
College of Engineering
Utah State University

August 16, 2013



Outline

1. My background
2. NSF TUES program
3. Web-based interactive computer simulation and animation (CSA) – a critical review
4. Demos of web-based interactive CSA learning modules
5. Concluding remarks



1. My Background

- Mechanical engineering (PhD in 1994, MS in 1988, BS in 1984)
- Research interest: technology-enhanced learning (clickers, tablet PCs, computer simulation and animation, intelligent tutoring systems,)
- Associate professor in the Department of Engineering Education at Utah State University

**Department of Engineering Education
at Utah State University**

- Within the College of Engineering <http://eed.usu.edu/>
- Teach: 2nd year foundational engineering courses (Statics, Dynamics, Strength of Materials, Electrical Circuits, Computer-Aided Design, etc.)
- Research: Pedagogical research in engineering education
 - ✓ PhD in Engineering Education program: one of the only three programs in the nation
 - ✓ 12 PhD students (these students have MS/BS in engineering and are interested in educational research)

NSF/DUE STEM Programs That I Was Involved

- **Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics (TUES) Program** (formerly CCLI program) that aims to improve undergraduate education in STEM disciplines.
- **Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP)** that aims to improve the recruitment and retention of STEM undergraduates.
- **NSF Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) Program** that provides scholarships to STEM undergraduates.
- **Advanced Technological Education (ATE) Program** that aims to improve technology education in community colleges.

2. NSF TUES Program

The vision of the TUES program is excellent STEM education for all undergraduate students, especially providing “transformative” learning experiences for students.

TUES Program Solicitation NSF 10-544

Most Up-to-Date

CAUSE (Catalyzing Advances in Undergraduate STEM Education) is an NSF-wide investment that incorporates funding from established programs in the EHR directorate and other NSF directorates funded through the Research and Related Activities (R&RA) account. It is created by consolidating three Division of Undergraduate Education (DUE) programs: *STEM Talent Expansion Program (STEP)*, *Widening Implementation and Demonstration of Evidence-based Reforms (WIDER)*, and *Transforming Undergraduate Education in STEM (TUES)*; several R&RA programs: BIO's Transforming Undergraduate Biology Education (TUBE); ENG's Research in Engineering Education and Nanotechnology Undergraduate Education (NUE); GEO's Geosciences Education and Opportunities for Enhancing Diversity in the Geosciences (OEDG); and the cross-NSF program, Climate Change Education (CCE).

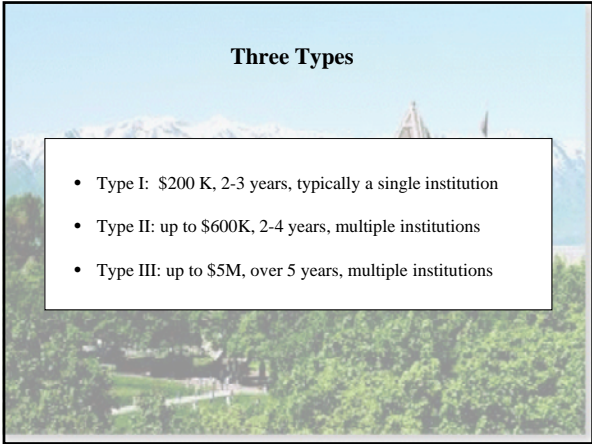
FY 2014 NSF Budget Request to Congress

TUES Program

- **Creating Learning Materials and Strategies**
 - ✓ Ex: web-based, interactive learning modules
 - ✓ Ex: learning materials for mobile learning (iphone, ipad,...)
- **Implementing New Instructional Strategies**
 - ✓ Ex: Peer-led guided inquiry
 - ✓ Ex: Collaborative problem-based learning
- **Developing Faculty Expertise**
 - ✓ Ex: faculty development workshops
 - ✓ Ex: virtual community of practices

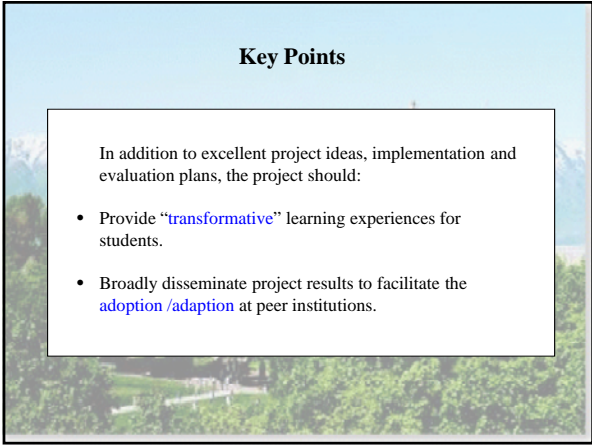
TUES Program (Continued)

- **Assessing and Evaluating Student Achievement**
 - ✓ Ex: assessment of students' self-regulated learning skills
 - ✓ Ex: assessment of students' problem-solving skills
- **Conducting Research on Undergraduate STEM Education**
 - ✓ Ex: How do students learn foundational engineering concepts?
 - ✓ Ex: What factors critically affect student retention?
 - ✓ Ex: How to best design web-based learning materials to optimize student learning outcomes, given diverse student populations (gender, learning styles, cultural background, ...)



Three Types

- Type I: \$200 K, 2-3 years, typically a single institution
- Type II: up to \$600K, 2-4 years, multiple institutions
- Type III: up to \$5M, over 5 years, multiple institutions



Key Points

In addition to excellent project ideas, implementation and evaluation plans, the project should:

- Provide “transformative” learning experiences for students.
- Broadly disseminate project results to facilitate the adoption /adaption at peer institutions.



3. Web-Based Interactive Computer Simulation and Animation (CSA) – A Critical Review

Advantages of Computer Simulation and Animation (CSA)

- Properly designed CSA helps **improve students' spatial abstract thinking skills** by enabling students to visualize various science and engineering phenomena.
- Particularly attractive to many contemporary tech-savvy students as it **promotes active and collaborative learning**, and can be easily and widely adopted at both formal and informal education sites with no requirement for expensive physical facilities and instrumentations.

Examples of NSF-Funded CSA Projects

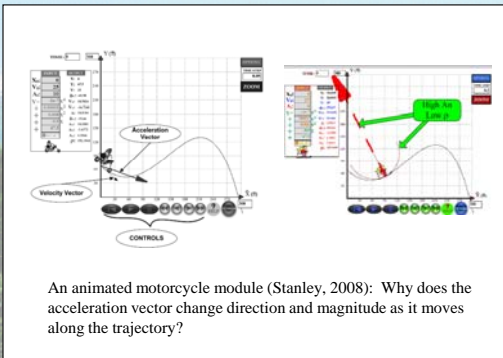
Project title	Institution
Development of Virtual CNC Machine Tools and Web-Based Machining Process Simulation and Learning	Missouri University of Science and Technology
An Inquiry-Based Simulation Learning Environment for the Ecology of Forest Growth	Hampshire College
Education Research Grant: Encouraging Students to Pursue Undergraduate Degrees in STEM Fields by Exposing them to Fundamental STEM Paradigms via Interactive Visual Arts Modules	Morehouse College
Introduction of Simulation Learning and Optimization to Support Engineering Design	University of Illinois at Urbana-Champaign
DIYModeling -- Do It Yourself Modeling and Simulation for STEM Learning	Texas Southern University
Modernizing the Undergraduate Power Engineering Curriculum with Real-Time Digital Simulation	Missouri University of Science and Technology
Interactive Simulation for Teaching Engineering Economics	Rowan University

Purpose of Literature Review

Purpose: understand the current status of design and implementation of computer simulation and animation (CSA) programs/modules

Scope: limited in foundational engineering mechanics courses: Statics, Dynamics, Engineering Mechanics, Strength of Materials; and several high school physics/mechanics

An Example Study



Study Characteristics

- Student learning outcomes
- Sample size of study
- Area of study
- Authoring software
- Proprietary
- Mathematical equations
- User controls
- Other media
- Experimental design
- Data collection

Results

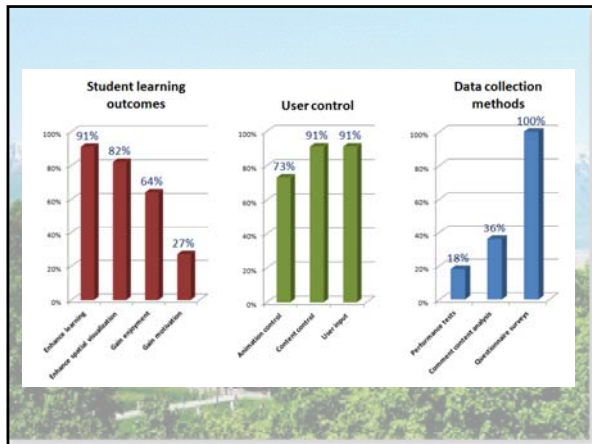
Study	Learning Outcomes	Sample Size	Area of Study	Authoring Software	Proprietary	Mathematical Equations	User Controls	Other Media	Experimental Design	Data Collection
Engel et al. (2006)	• Enhance learning visualization • Enhance spatial visualization • Gain Engagement • Gain Motivation	50 (2004) 80 (2005)	Dynamics	Macromedia Flash	N	Y	• Animation control • Content Control • User inputs	None	One-Shot Case Study	• Questionnaire
Corwell (2000)	• Enhance learning visualization • Enhance spatial visualization • Gain Engagement • Gain Motivation	Other	Dynamics	Working Model	Y	N	• Animation control • Content Control	None	One-Shot Case Study	• Questionnaire
Hiding et al. (2003)	• Enhance learning visualization • Enhance spatial visualization • Gain Engagement • Gain Motivation	53	Statics	Adobe Flash	N	Y	• Animation control • Content Control • User inputs	None	Static Group Comparison Design	• Comment content analysis • Performance Test • Questionnaire
Masse (2003)	• Enhance learning visualization • Enhance spatial visualization • Gain Engagement	100	Dynamics	MSC Adams	Y	Y	• Content Control • User inputs	None	One-Shot Case Study	• Questionnaire
Stoffs, Barnes, & Tapanney (2005)	• Enhance learning visualization • Enhance spatial visualization • Gain Engagement	Other	Dynamics	Macromedia Director	N	Y	• Animation control • Content Control • User inputs	None	One-Shot Case Study	• Questionnaire

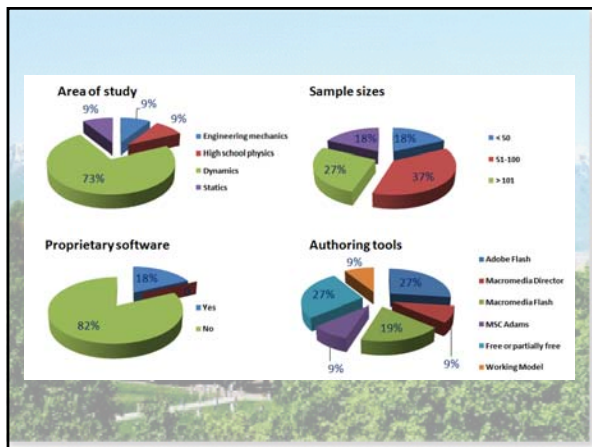
Results (Continued)

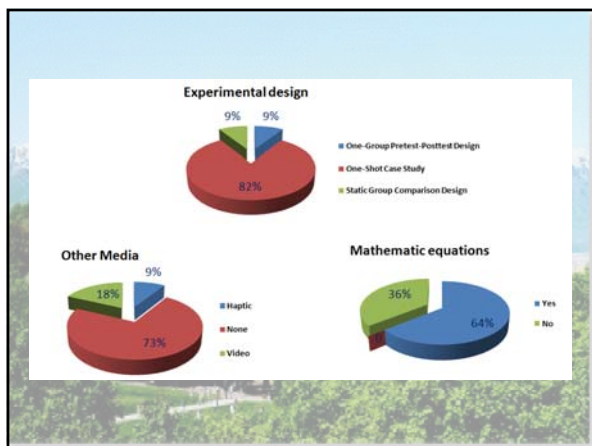
Study	Learning outcomes	Sample size	Area of study	Authoring Software	Proprietary	User controls	Other media	Experiment Design	Data collection
William et al. (2007)	* Enhance learning	26	High school Physics	Free or partially free (HTML, C++, DirectX, and OpenGL)	N	* Animation control * Content Control * User inputs	Haptic	One-Shot Case Study	* Comment content analysis * Questionnaire
Ali et al. (2007)	* Enhance learning * Enhance spatial visualization * Gain Enjoyment	58	Dynamics	Free or partially free (HTML, Java, and Jython)	N	* Animation control * Content Control * User inputs	Video	One-Shot Case Study	* Questionnaire
Fang (2008)		94	Dynamics	Free or partially free (C++ and OpenGL)	N	* User inputs	None	One-Shot Case Study	* Comment content analysis * Questionnaire
Stanley (2008, 2009)	* Enhance learning * Enhance spatial visualization * Gain Enjoyment	70	Dynamics	Adobe Flash	N	* Animation control * Content Control * User inputs	None	One-Shot Case Study	* Questionnaire
Deliktas (2011)	* Enhance learning * Enhance spatial visualization * Gain Enjoyment	383	Engineering Mechanics	Macromedia Flash	N	* Animation control * Content Control * User inputs	Video	One-Shot Case Study	* Questionnaire
Fang (2012)	* Enhance learning * Enhance spatial visualization	304	Dynamics	Adobe Flash	N	* Content Control * User inputs	None	One-Group Pretest-Posttest Design	* Comment content analysis * Performance Test * Questionnaire

Study	Learning outcomes	Sample Size	Area of study	Authoring Software	Proprietary
Hubing et al. (2002)	* Enhance learning * Enhance visualization * Gain Motivation	51	Statics	Adobe Flash	N
Mazzei (2003)	* Enhance learning * Enhance visualization * Gain Enjoyment	100	Dynamics	MSC Adams	Y
William et al. (2007)	* Enhance learning	26	High school Physics	Free or partially free (HTML, C++, DirectX, and OpenGL)	N
Stanley (2008, 2009)	* Enhance learning * Enhance visualization * Gain Enjoyment	70	Dynamics	Adobe Flash	N
Deliktas (2011)	* Enhance learning * Enhance visualization * Gain Enjoyment	383	Engineering Mechanics	Macromedia Flash	N

Study	Math equation	User Controls	Other media	Experiment Design	Data collection Methods
Hubing et al. (2002)	Y	* Animation control * Content Control * User inputs	None	Static-Group Comparison Design	* Comment content analysis * Performance Test * Questionnaire
Mazzei (2003)	Y	* Content Control * User inputs	None	One-Shot Case Study	* Questionnaire
William et al. (2007)	N	* Animation control * Content Control * User inputs	Haptic	One-Shot Case Study	* Comment content analysis * Questionnaire
Stanley (2008, 2009)	N	* Animation control * Content Control * User inputs	None	One-Shot Case Study	* Questionnaire
Deliktas (2011)	Y	* Animation control * Content Control * User inputs	Video	One-Shot Case Study	* Questionnaire







Suggestions

Design of CSA programs/modules:

- More animation controls
- Diverse representations of information
- Free web browser plug-ins
- Mathematic equations
- “Copy & Paste”

Assessment of student learning outcomes:

- Random assignments
- Control group, pre and post tests
- Diverse methods of data collection and more performance tests

4. Demos of Web-Based Interactive CSA Learning Modules

- TUES Type 2 project “Improving Students’ Problem-Solving in Engineering Dynamics Through Interactive Web-based Simulation and Animation Modules” (2011-2015)

- Phase I (1.5 years): **Develop** a unique set of CSA modules for both particle and rigid-body dynamics
- Phase II (2.5 years): **Assess** the effectiveness of the developed CSA modules using the quasi-experimental research design method: control group and treatment group.

Engineering Dynamics

- High-enrollment and high-impact, core engineering course that **nearly all mechanical, civil, and aerospace engineering students are required to take.**
- Covering a broad spectrum of foundational concepts and principles, such as motion, force and acceleration, work and energy, impulse and momentum, and vibration.
- One of the most difficult engineering courses to succeed in. In the Fundamentals of Engineering examination in 2009, **the national average score for the Engineering Dynamics exam was only 53%.**

Challenges of Student Learning in Dynamics

- Spatial abstract thinking and reasoning skills to correctly understand *what* physically happens in a dynamics phenomenon and to identify correct dynamics concepts and principles associated with that particular phenomenon.
- Analytical and mathematical modeling skills to help students translate their physical understanding into mathematical equations that accurately explain and describe *why* that particular dynamics phenomenon occurs and *how* it evolves.

Features of the New CSA Learning Modules

- Integrates visualization with mathematical modeling
- Interactive computer graphical user interface allows students to vary inputs and see how the numerical numbers in mathematical equations change, simultaneously and dynamically, as a physical object moves in a space
- Web-based and stand-alone computer software program.

Examples of the CSA Learning Modules

Learning Objective

Apply Newton's second law to determine the force acting on a particle and the acceleration of a particle in rectangular motion, based on rectangular coordinates.

Which Block A Moves Faster?

Given: $m_A = 100 \text{ kg}$, $m_B = 100 \text{ kg}$, Coefficient of kinetic friction between block A and the ground, $\mu_k = 0.2$

Find: The acceleration of Block A.

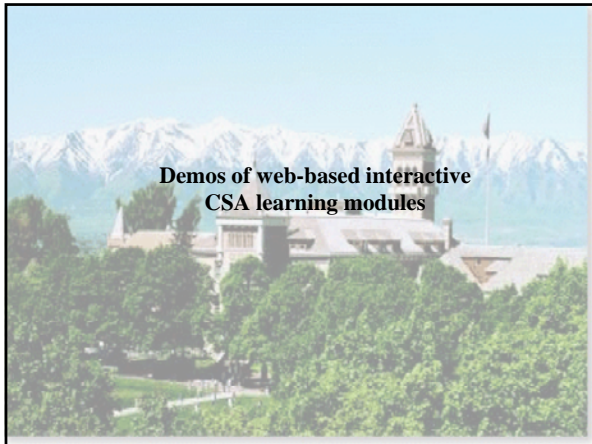
The interface shows two cases: 'The Left Case' and 'The Right Case'. Each case includes a diagram of a block on an inclined plane, a free-body diagram, and a table of forces and equations.

The Left Case

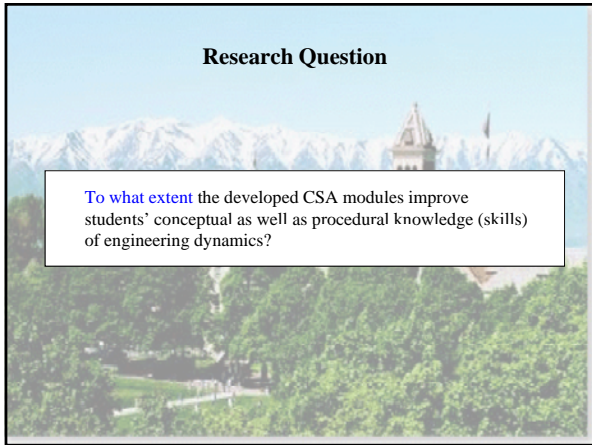
Block A: $F_{net,x} = T - \mu_k N_A = m_A a_A$ (Equation 1)
 $N_A = m_A g \cos(\theta)$ (Equation 2)
 $F_{net,y} = T - m_A g \sin(\theta) - \mu_k m_A g \cos(\theta) = m_A a_A$ (Equation 3)

The Right Case

Block A: $F_{net,x} = T - \mu_k N_A = m_A a_A$ (Equation 1)
 $N_A = m_A g \cos(\theta)$ (Equation 2)
 $F_{net,y} = T - m_A g \sin(\theta) - \mu_k m_A g \cos(\theta) = m_A a_A$ (Equation 3)

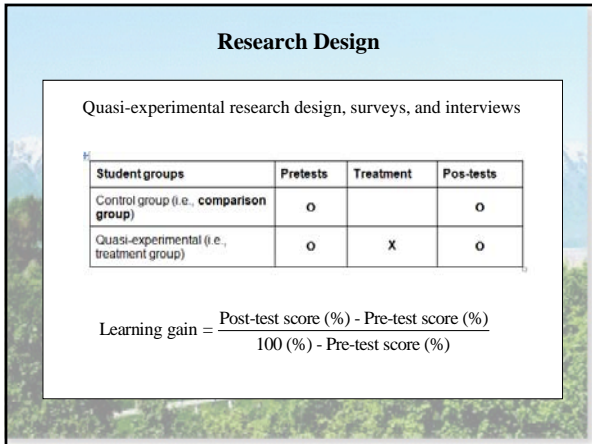


**Demos of web-based interactive
CSA learning modules**



Research Question

To what extent the developed CSA modules improve students' conceptual as well as procedural knowledge (skills) of engineering dynamics?



Research Design

Quasi-experimental research design, surveys, and interviews

Student groups	Pretests	Treatment	Pos-tests
Control group (i.e., comparison group)	o		o
Quasi-experimental (i.e., treatment group)	o	X	o

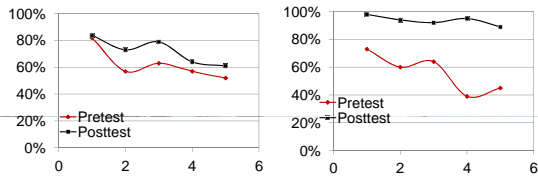
$$\text{Learning gain} = \frac{\text{Post-test score (\%)} - \text{Pre-test score (\%)}}{100 (\%) - \text{Pre-test score (\%)}}$$

Student Participants

Control semester: 86 students from three departments: mechanical and aerospace engineering, civil and environmental engineering, biological engineering

Treatment semester: 94 students from the above three engineering departments

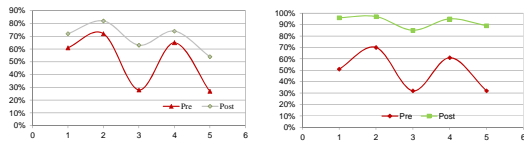
Preliminary Results



CSA Module 2

- Control semester: Class-average learning gain 16%
- Treatment semester: Class-average learning gain 62%

Continued



CSA Module 4

- Control semester: Class-average learning gain 21%
- Treatment semester: Class-average learning gain 69%

Student Comments

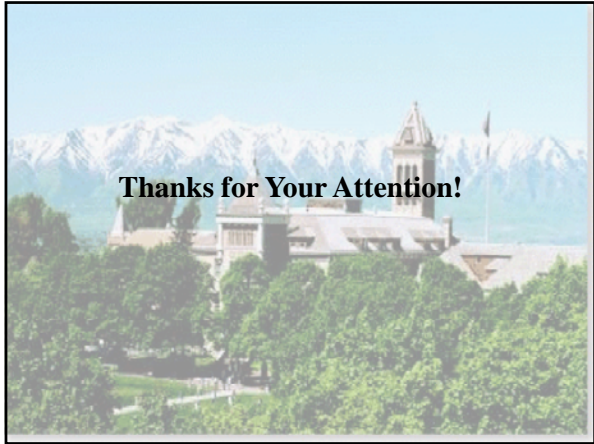
- “When [visual and math come together](#), see and understand much better.”
- “I was able to see the math laid out in front of me. Then I can see the physics as it moves in real life. [This links the two.](#)”
- “They helped me see that happens and [see why.](#)”
- “I could see how different factors changed the simulation and in what way.”
- “They helped me visualize the relationships of how the mathematics changes when the calculations are altered.”

Student Comments

- “Seeing physical demonstrations definitely helps to [understand what the math is describing.](#)”
- “They help me [connect what is happening conceptually to mathematically.](#)”
- “It helped me visualize what was happening & see how the physics and mathematics were related.”
- “The computer simulation made it possible to visualize some concepts that were not as easy to see just on paper.”
- “It was nice to “instantly” see if my intuition was correct or not.”
- “For some of the problems my institution was incorrect and the computer simulations helped illustrate the mathematical proof of the problem.”

5. Concluding Remarks

- If designed properly, web-based interactive computer simulation and animation (CSA) programs/modules can improve student learning.
- When designing CSA programs/modules, it is suggested to consider:
 - ✓ More animation controls
 - ✓ Diverse representations of information
 - ✓ Free web browser plug-ins
 - ✓ Mathematic equations



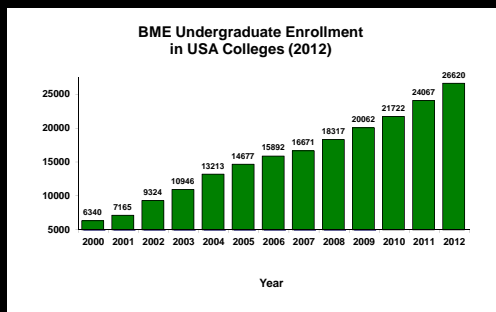
Medical Imaging Education by Online Animation and Simulation

Weizhao Zhao, Ph.D.
Department of Biomedical Engineering
University of Miami, Coral Gables, Florida

Background: Facts

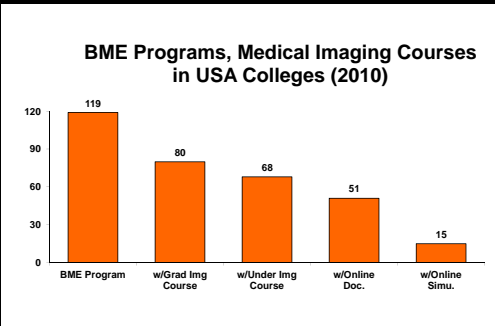
- BME education has developed as an **interdisciplinary engineering** training area in the last 30 years.
- Medical Imaging is a **required training** area in BME and almost any health care related major, e.g., medical physics, health science.
- Medical Imaging techniques are applied in clinical and research laboratories on a daily basis.
- Medical Imaging instrument is usually **unavailable** (even available, it is usually **not accessible**).

Background: Facts



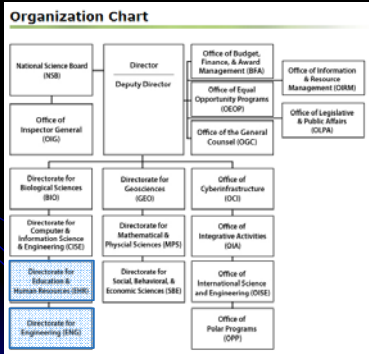
<http://www.asee.org/papers-and-publications/publications/11-47.pdf>

Background: Facts



<http://mis.eng.miami.edu/survey>

Background: Resource



Background: Resource



EHR Directorate

Graduate Education (DGE)

Research on Learning in Formal and Informal Settings (DRL)

Undergraduate Education (DUE)

Human Resource Development (HRD)

ENG Directorate

Chemical, Bioengineering

Environmental, and Transport Systems (CBET)

Civil, Mechanical and Manufacturing Innovation (CMMI)

Electrical, Communications and Cyber Systems (ECCS)

Engineering Education and Centers (EEC)

Emerging Frontiers in Research and Innovation (EFRI)

Industrial Innovation and Partnerships (IIP)

History: Success



NSF CCLI DUE0127290 (2001-2004)
"Proof of Concept"

NSF CCLI DUE0632752 (2006-2009)
"Build a Prototype"

NSF TUES DUE1022750 (2010-2014, **Current**)
"Expansion Development"

NSF DUE 1022750

Florida Atlantic University
Florida International University
University of Miami

Collaborative Development and Application of
Distributable, Internet Accessible, Interactive
Medical Imaging Teaching Software (MITS) and
Dynamic Assessment Tracking System (DATS)

Motivation

- You hear, you forget.
- You see, you remember.
- You do, you understand.
- **What do you see and what do you do?**
- A picture is worth a thousand words: you see!
- A moving picture is even better: you see more!
- An interactive moving picture is better than a simple moving pictures: you do too!

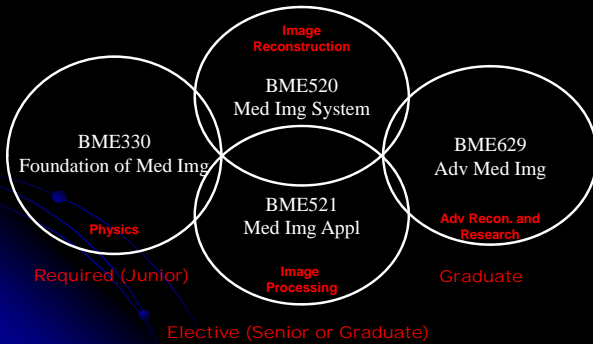
Hypothesis

Web-based interactive teaching model increases student learning gain in the field of medical imaging education, particularly for biomedical engineering students.

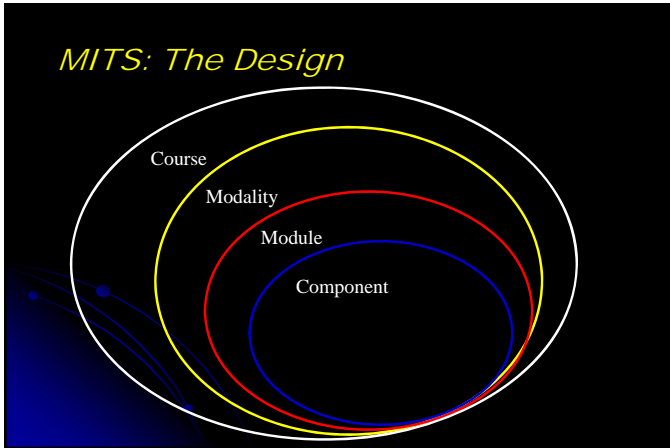
Objective

- Develop an online learning environment to help successfully deliver medical imaging curriculum
MITS: Medical Imaging Teaching Software
- Develop an online tracking platform to evaluate teaching effectiveness and assess student learning gain
DATS: Dynamic Assessment Tracking System

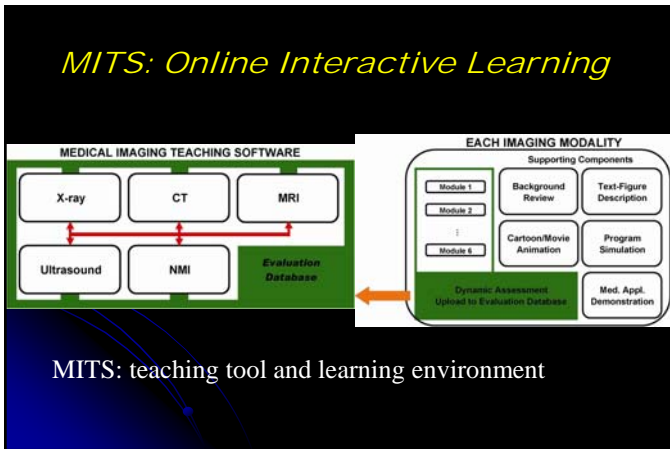
Curriculum in UM's BME



MITS: The Design



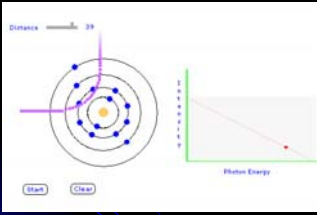
MITS: Online Interactive Learning



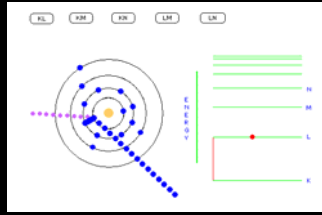
MITS: teaching tool and learning environment

MITS: Dynamically Generated Webpage

Animation and Simulation



General Radiation



Characteristic Radiation

Animation and Simulation

Animation Example

Either you can explain the following equation and ask student to write codes to simulate CT projection...

$$p(x', \theta) = \sum_{\text{vertebra axis}} f(x \cdot \cos \theta + y \cdot \sin \theta, -x \cdot \sin \theta + y \cdot \cos \theta)$$

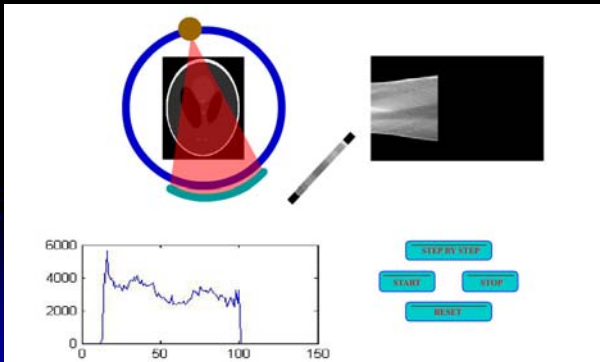
$$= \sum_{y'} f(x \cdot \cos \theta + y \cdot \sin \theta, y') \quad \forall \theta$$

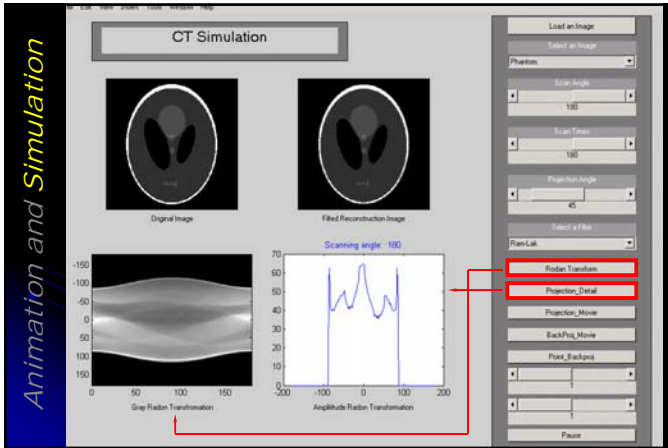
OR

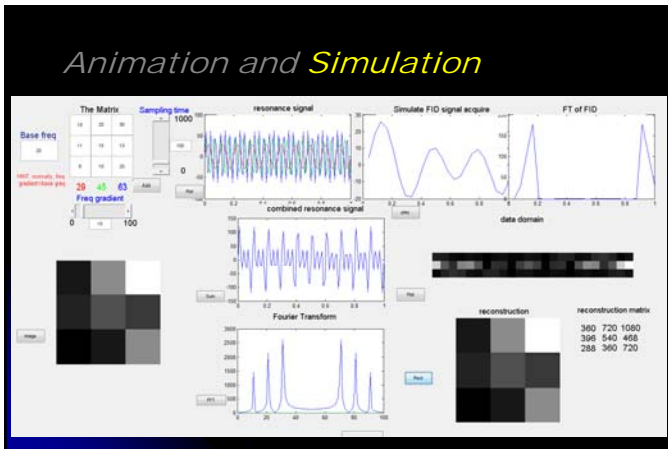
And explain the following equation and ask students to write codes to simulate CT reconstruction...

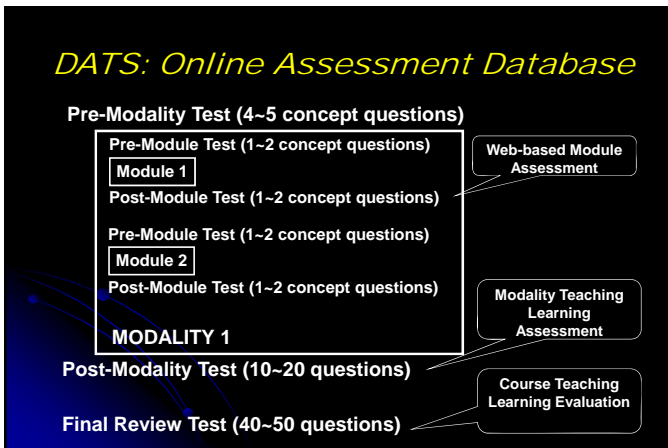
$$g(x, y) = \sum_{\theta} p(x', \theta) = \sum_{\theta} p(x \cdot \cos \theta + y \cdot \sin \theta, \theta) \quad \forall \theta$$

Animation and Simulation





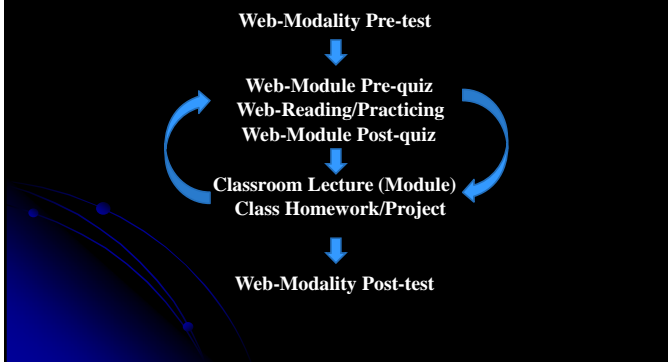




DATS: Module Information

DATS: Manager of MITS

Application: Hybrid Approach



Animation and Simulation:

X-ray Modality:

- X-Ray Tube's working principle
- X-Ray Tube's emission spectrum
- Inner shell ionization
- Bremsstrahlung radiation
- Compton Scattering
- Half Value Layer
- Attenuation
- X-ray Geometry

Animation and Simulation:

CT Modality:

- Pen-beam projection
- Fan-beam projection
- Back projection by degree in Radon domain
- Back projection by Cartesian coordinate
- Downloadable CT **Simulation**
- Numerical reconstruction

Animation and Simulation:

MRI Modality:

- Precession
- Larmor frequency and RF pulse
- MRI Relaxation
- Downloadable FID **Simulation**
- Downloadable Reconstruction **Simulation**

Animation and Simulation:

Nuclear Medicine Modalities:

- Radioactive decay through materials
- How PET works
- How SPECT works
- Radionuclide half-life
- Coincidence Sampling
- PET demonstration
- Reconstruction demonstration
- To be uploaded **animations** by FIU
- To be uploaded **simulations** by FIU

Animation and Simulation:

Ultrasound Imaging Modality:

- A-mode Ultrasound
- M-mode Ultrasound
- B-mode Ultrasound
- Doppler Effect
- To be uploaded **animations** by FAU
- To be uploaded **simulations** by FAU

Collaboration: "Users"

• Contacted:

- University of Valencia (EE), Spain
- University Pompeu Fabra in Barcelona (BME), Spain
- IIT Roorkee (ECE), India
- Ariel University (MP), Isarel
- University of Western Ontario (ECE), Canada
- Medical School Athens, Greece
- Università degli Studi di Milano (Rad), Italy
- Baylor College of Medicine (MH), TX
- Duke University (CoE), NC
- DeVry University (BMETS), CA
- Rose-Hulman Institute of Technology (MP), NJ
- Wentworth Institute of Technology (BME), MA
- Catholic University of America (ECE/BME), DC
- Prairie View A&M University (PHY/BME), TX
- University of North Carolina (BME), NC
- Broward College (HS), FL

• Participating

- Florida Atlantic University
- Florida International University
- University of Miami

Application: "Protocols"

BME330: Foundation of Medical Imaging

> Primary teaching material: Textbook, Instructor's handout

> MITS/DATS system: Reference material, volunteer

> Pre/Post test/quiz: Extra credits

BME520: Medical Imaging System

> Primary teaching material: Textbook, No handout

> MITS/DATS system: Hybrid with textbook to serve as handout material, volunteer

> Pre/Post test/quiz: for review only, NO extra credits

Results Subjective perception information

21 student responses	5 - 4	3	2 - 1
Rating 5:strongly agree - 1:strongly disagree			
1. The simulation protocol is well organized (*)	18	3	0
2. The interface of the protocol is user-friendly (*)	16	5	0
3. The protocol provides you ample opportunities to gain knowledge, skill and technique that traditional lecture or textbook cannot provide (*, #)	20	1	0
4. The visual feature stimulates your interest of learning a subject (*)	21	0	0
5. The physics and mathematics concepts link closely the engineering implementation (*, #)	18	3	0
6. Simulation exercises enhance your understanding to a particular modality (*, #)	21	0	0
7. Overall usefulness of the simulation protocol to current course (*, #)	20	1	0

Results Factual information

214 students (154 undergraduates) took medical imaging courses

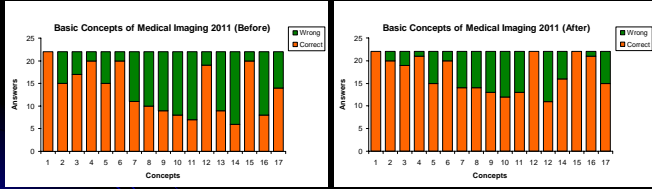
For modality X-ray and CT (pre/post test)

	GPA	All Prob.	Concept Prob.	Projects
Pre (n=23)	3.42±0.34	82±9%	76±5%	82±5%
Post (n=21)	3.46±0.44	89±8%	91±6%	90±6%

1: $p < 0.7$ 2: $p < 0.1$ 3: $p < 0.05$

Results Learning Gain

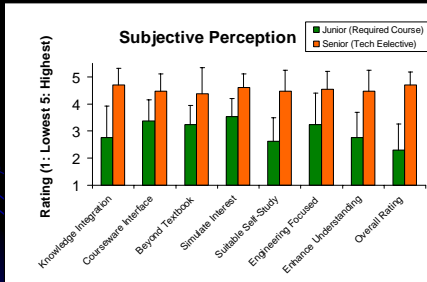
Result: Concept understanding quiz (BME520)



Learning Gain (2011):
 $LG = (\text{post-pre}) / (100 - \text{pre}) = 0.36 \pm 0.28$

Results Subjective perception

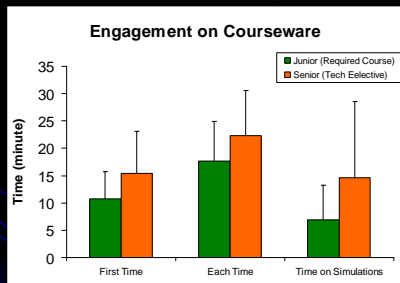
Result: Survey from classes (BME330/520)



Apparent subjective perception "disparity" between classes

Results Engagement

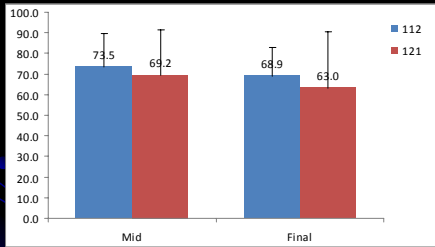
Result: Time used on MITS (BME330/520)



Apparent subjective perception "disparity" between classes

Results Grade Impact

Result: Midterm/Final exam (BME330)



112: 73.5+/-16 and 68.9+/-14 (N=12), lowest grade B (n=4)
121: 69.2+/-22 and 63.0+/-27 (N=24), lowest grade F (n=1), D (n=1), C (n=3)

Results Comments

Result: Open end survey (BME330/520)

Summary:

- Animations of the underlying physics behind modalities...
- Organized well and provided visualization...
- Good summary for class review...
- Remote accessible, self-paced...
- Practice test/quiz help review...
- Format is not consistent...
- Index is not clear...
- Pre/post quiz does not match content/class material...
- Class test questions are too difficult and some not relevant...
- Too much text...
- Can you put the website on Blackboard...

Conclusion

- MITS provides an Internet accessible, interactive, module based teaching tool and learning environment
- DATS manages MITS through a database platform, provides quick feedback for teaching efficiency and assesses student learning gain dynamically

Future Work

- Seeking for collaboration to apply the system under different settings, such as BME, ECE, HS, PHY, or other curricula.
- Seeking for NSF proposal collaborators: Medical Imaging through CyberLearning
- Seeking for collaborative research on Integration of Medical Imaging into Special Applications, e.g., Medical Physics program, Health Science program

Acknowledgement

NSF CCLI DUE0127290 (2002-2004), "Proof of a Concept"
NSF CCLI DUE0632752 (2006-2009), "Build a Prototype"
NSF CCLI DUE1022750 (2010-2014), "Expansion Development"

External Advisory Committee

Dr. Thomas Harris, Director NSF EEC
Dept. of Biomedical Engineering, Vanderbilt University
Dr. Autar Kaw, ASEE Distinguished Scholar 2011, US Professors of the Year, 2012
Dept. of Mechanical Engineering, University of South Florida

Graduate Students

David Wu, Aditya Dixie, Chunyan Wu, Alon Mozes, Jack Lu,
Qian Shen, Xiping Li, Decho Surangsrirat, Wupeng Yin, Hairong Chen

NSF CCLI/TUES Program Directors

Dr. Russell L. Pimmel, Dr. Don L. Millard

<http://mis.eng.miami.edu>

Questions?

<http://mis.eng.miami.edu>

NSF National Workshop on Medical Imaging Teaching Software

University of Miami – 16 August 2013



1

Florida Atlantic University Modules

Ultrasound Imaging Image Processing

Ricardo Castellanos
Diego Pava
Prof. Nurgun Erdol
Prof. William Rhodes

2

Medical Imaging Course Testbeds

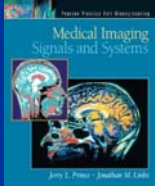
- Fa10 Florida Atlantic University - 10 students
- Sp12 Florida Atlantic University - 12 students
- Sp12 Universidad Javeriana - 30 students
- Sp13 Universidad Javeriana - 26 students

Total of 78 students (all from engineering)

3

Course Text:

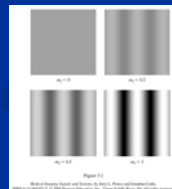
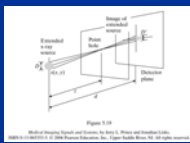
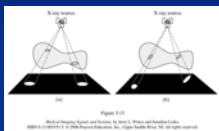
Medical Imaging Signals and Systems by Prince & Links



An excellent text for students with background in engineering and physics, but short on figures in certain areas: a good candidate for augmentation with animations.

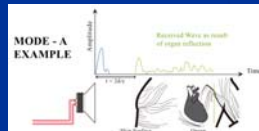
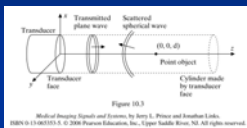
4

Representative Examples



5

Ultrasound Imaging



- Presentation by Ricardo Castellanos (Ph.D. candidate in electrical engineering)

6

Image Processing for Medical Imaging



Image Processing Innotool
For Medical Imaging

*A Matlab-based teaching
software package and tutorial*

Diego F. Pava
Florida Atlantic University

- Presentation by Diego Pava (Ph.D. candidate in electrical engineering)

7





Web Based Interactive Medical Imaging Applications for Teaching Nuclear Medicine

Senait A. Debebe, Ruchir Bhatt, Anthony J. McGoron
 Department of Biomedical Engineering , Florida International University, Miami, FL, U.S.A.




Our Goal




- Develop interactive medical imaging applications focused in Nuclear medicine
- Establish internet accessible applications
- Sharable, distributable and upgradable applications
- Increase students learning gain by conveying dynamic explanations.
- Flexible learning schedule to fit into the available class hours.

2



I. PET Simulation



- MATLAB® was used to simulate PET image reconstruction mechanism.
- Scattering and random coincidence effects were simulated by adding Gaussian and/or Poisson noise.
- Radon transform was performed to generate *sinogram* of an image.
- Filtered Back Projection algorithm was used to reconstruct the original image

3

FIU

II. Tracer Kinetics Model

- The relationship among Input function (Plasma activity), Tissue response, model structure and rate constants was illustrated using 3-compartmental models.
- MATLAB® GUIDE has been used to develop a user interface.
- Background MATLAB program has been used to implement:
 $A_t = (Input\ Function) \otimes Tissue\ Response$
 Where A_t is the measured data by PET

4

© 1994-2000 Crump Institute for Molecular Imaging
UCLA School of Medicine

FIU

III. Reporter Gene Imaging

- Animation of PET reporter gene imaging was performed.

- Adobe® Flash® Professional CS5 was used together with ActionScript 3.0 to apply codes .

5

IV. Coincidence detection

- Circuitry of PET coincidence detection, generation of single and multiple incidences are animated.

- Adobe® Flash® Professional CS5 was used.

6

Courtesy of: "The promise of Immuno-PET in Radioimmunotherapy", *J Nucl Med January 1, 2005 vol. 46 no. 1*

V. Autoradiography

- Procedures and materials required to do Autoradiography is animated which is used determine the distribution of radioactivity.

- Adobe® Flash® Professional CS5 was used.

Copyright © 2010, InvivoPharm Inc

Results

1.

Activities

- Choose to add Gaussian and/or Poisson noise
- Set STD value;
- Enter angle spacing between projection angle of Radon transform
- Adjust image reconstruction parameters ; filter type & cutoff frequency
- Help files provided

Results Cont.

2.

Activities

- Choose between models
- Click on input functions (PTACs)
- Enter estimated rate constant values (K_i)
- Observe the resulting TTACs

Results Cont.

3.

PET REPORTER GENE IMAGING

Activities

- Step by step procedures are animated.
- Reporter gene injection and its route inside a liver cell is elaborated.
- Reporter probe interaction with expressed proteins/enzymes/receptors is shown.
- Start, forward and backward buttons are provided.

10

Results Cont.

4.

LOR

1 min to locate coincident events where the counts in counter are above which event is the first event. There are in total four LOR. The LOR are from the four coincident.

Activities

- Start button to start the animation
- Coincidence detection circuitry is animated
- Step by step explanation of signal generation
- Next button to go to the next step

11

Results Cont.

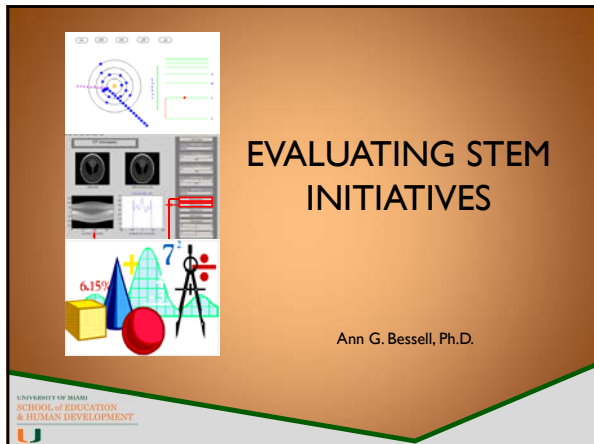
5.

The rat is than flash freeze with liquid nitrogen

Activities

- Start button to start the animation
- Injection and distribution of radioisotope, and technique of autoradiograph is animated
- Step by step explanation materials and methods applied
- Next button to go to the next step

12




EVALUATING STEM INITIATIVES

Ann G. Bessell, Ph.D.

UNIVERSITY OF MIAMI
SCHOOL OF EDUCATION
& HUMAN DEVELOPMENT

WHAT IS

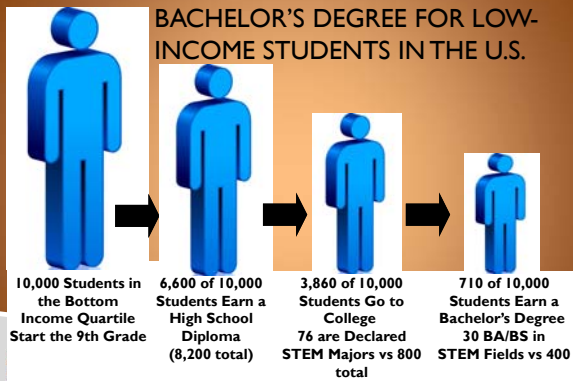


Beyond **S**cience, **T**echnology, **E**ngineering and **M**ath

STEM education attempts to transform the typical professor-centered classroom by encouraging a curriculum that is driven by problem-solving, discovery, exploratory learning, and requires students to actively engage a situation in order to find its solution.

UNIVERSITY OF MIAMI
SCHOOL OF EDUCATION
& HUMAN DEVELOPMENT

STEM PIPELINE FROM 9TH GRADE TO BACHELOR'S DEGREE FOR LOW-INCOME STUDENTS IN THE U.S.



10,000 Students in the Bottom Income Quartile Start the 9th Grade	6,600 of 10,000 Students Earn a High School Diploma (8,200 total)	3,860 of 10,000 Students Go to College 76 are Declared STEM Majors vs 800 total	710 of 10,000 Students Earn a Bachelor's Degree 30 BA/BS in STEM Fields vs 400 total
---	---	--	---


UNIVERSITY OF MIAMI

THINK OUTSIDE THE BOX: PROBLEMS

- Convert the following figure into a six by adding only one line.

IX

- Leave two squares in the following figure by removing just two lines.




UNIVERSITY OF MIAMI
SCHOOL OF EDUCATION
& HUMAN DEVELOPMENT
©15/2013

THINK OUTSIDE THE BOX: SOLUTIONS

- Convert the following figure into a six by adding only one line.

SIX

- Leave two squares in the following figure by removing just two lines.



UNIVERSITY OF MIAMI
SCHOOL OF EDUCATION
& HUMAN DEVELOPMENT
©15/2013


10 ESSENTIAL STEM TEACHING PRACTICES

- 1. Believe in your students.** Set high expectations for your students, challenge them to succeed, and believe that they will.
- 2. Transfer control of the learning process to the students.** Develop new roles and rules that stress student responsibility. Then guide from the sidelines while keeping students on target with their direction and purpose.
- 3. Foster curiosity.** Pose problems rather than answers and send students on a search for solutions. Use discrepant events to intrigue students and draw them into the problem.
- 4. Provide hands-on, experiential learning.** Don't be the old-fashioned sage on the stage. Learning through reflection and doing is compelling. When your students have their imagination piqued, give them opportunities to actually investigate multiple possible solutions to a problem, or to solve a mystery.

UNIVERSITY OF MIAMI
SCHOOL OF EDUCATION
& HUMAN DEVELOPMENT
©15/2013

- ▶ **5. Increase collaboration among students.** Get comfortable with teamwork.
- ▶ **6. Accept failure – both yours and the students – as a necessary part of learning and growing.** That is, accept failure that accompanies taking a risk and experimenting, knowing that they might not get it right.
- ▶ **7. Be an inspiring leader and role model for your students.** Be positive and enthusiastic about what students are learning and how they are learning it.
- ▶ **8. Accept some drawbacks.** STEM education will improve student engagement, critical thinking skills, and workforce skills. But you'll need to be flexible and ready to make some quick shifts in your thinking.
- ▶ **9. Evolve and grow as a learner.** Develop your skills in facilitating (as opposed to dictating) so that students focus on learning how to think like a STEM professional.
- ▶ **10. Learn in community.** Work with your colleagues to study effective ways of teaching STEM lessons.

UNIVERSITY OF MIAMI
SCHOOL OF EDUCATION
& HUMAN DEVELOPMENT



REASONS FOR EVALUATION

- ▶ Performance improvement
- ▶ Outcome assessment
- ▶ Program justification
- ▶ Accountability
- ▶ Program clarification
- ▶ Cost-effectiveness


UNIVERSITY OF MIAMI
SCHOOL OF EDUCATION
& HUMAN DEVELOPMENT



RESULTS-BASED ACCOUNTABILITY™

- ▶ **Results (or outcomes or goals)** as "A condition of success for students, professors, program of study, or school." This can include some of the major junctures in a student's education where they can continue on a trajectory toward success or fall back/fall through the cracks.
- ▶ **Indicators (or benchmarks)** which are the "what" that can be measured to help quantify the achievement of an outcome. Each program needs to identify the appropriate indicators for their program by answering the question "How would we recognize these outcomes in measureable terms?"
- ▶ **Performance Measures.** These are the metrics that will be used to measure how well a program, course, or career path is working. Each program needs to identify the appropriate metrics for their program by answering questions like "How much did we do?, How well did we do it?, What are the effects/gains for the participants?"

UNIVERSITY OF MIAMI
SCHOOL OF EDUCATION
& HUMAN DEVELOPMENT



EVALUATION PLANNING

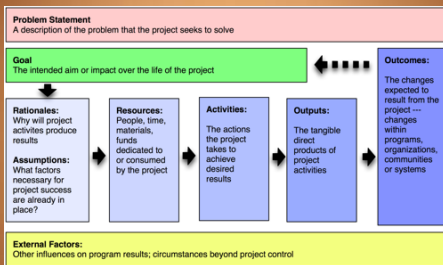
Most STEM evaluation proposals ask for three elements but use different language:

- ▶ “Fidelity of Implementation” or just “fidelity” measures the extent to which the program activities have been accomplished.
- ▶ “Formative” or “process” evaluation provides mid-course corrections to Pis.
- ▶ “Summative” or “impact” evaluation summarizes the programs merit and worth.

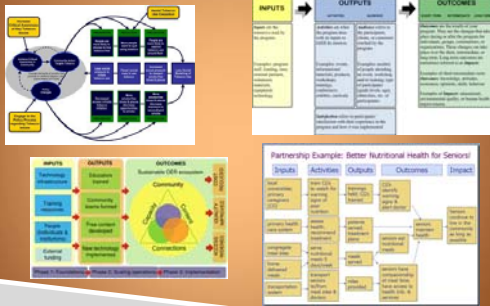
THEORY OF PROGRAM CHANGE:

- ▶ “...a static, fixed, and mechanical cause-effect model where inputs lead to outputs, which produce outcomes and impacts...”
- ▶ “Works well in simple situations of high certainty and high agreement about what to do. But such modeling has significant downsides and distorting effects in complex and dynamic situations where the [program] is emerging, evolving, and adapting.” MQP 2011

BASIC LOGIC MODEL

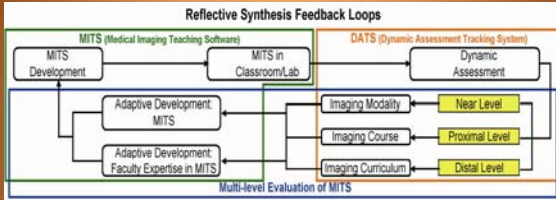


LOGIC MODELS



UNIVERSITY OF MIAMI
SCHOOL OF EDUCATION
& HUMAN DEVELOPMENT

Reflective Synthesis Feedback Loops





STRUCTURE OF A COLLABORATIVE

Proposed structural design illustrating the dynamic relationship between a multidisciplinary team and network collaborators. A = external universities, B = external research centers, C = independent researchers/labs, D = pharmaceutical companies/labs, E = governmental agencies/labs, F = clinical research support (bio-repositories, biostatistics, clinical research units, etc.)

UNIVERSITY OF MIAMI
SCHOOL of EDUCATION
& HUMAN DEVELOPMENT

INPUTS

Resources, contributions, investments that go into the project. Input indicators measure resources, contributions and investments such as:

- Staff
- Volunteers
- Funding
- Materials
- Facilities

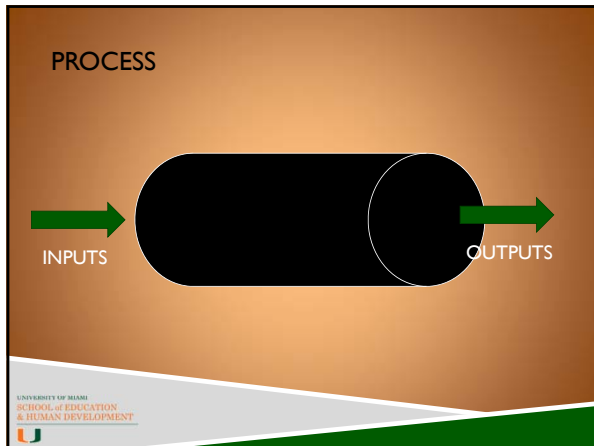
UNIVERSITY OF MIAMI
SCHOOL of EDUCATION
& HUMAN DEVELOPMENT

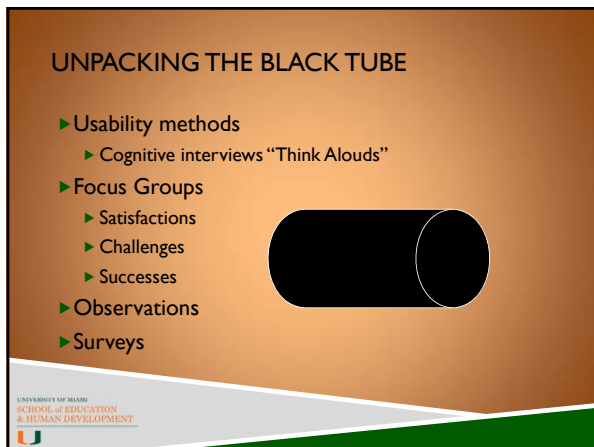
OUTPUTS

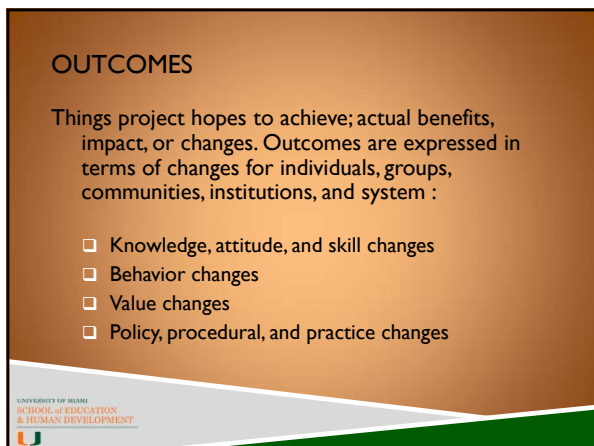
Output indicators measure things such as the scope/size of activities, services, events, and products reaching the target population:

- Numbers of students served
- Number of simulations completed
- Number of courses
- Numbers of workshops

UNIVERSITY OF MIAMI
SCHOOL of EDUCATION
& HUMAN DEVELOPMENT








CONSIDERING BP SUCCESS AT MULTIPLE LEVELS

- Level 1:** Having access to the *benefits* of STEM knowledge
- Level 2:** Having access to STEM knowledge
- Level 3:** Studying STEM
- Level 4:** Working in STEM areas
- Level 5:** Generating STEM knowledge

UNIVERSITY OF MIAMI
SCHOOL of EDUCATION & HUMAN DEVELOPMENT

11. ON A SCALE OF 1 TO 10, HOW SATISFIED ARE YOU WITH YOUR SIMULATION EXPERIENCE?

1. 1 (lowest)
2. 2
3. 3
4. 4
5. 5
6. 6
7. 7
8. 8
9. 9
10. 10 (highest)



UNIVERSITY OF MIAMI
SCHOOL of EDUCATION & HUMAN DEVELOPMENT

BRIEFS AS A WAY TO DISSEMINATE



BUSINESS PARTNERSHIPS TO ADVANCE STEM EDUCATION:

Building a Bridge to Homegrown STEM Talent
Focus on Teachers

UNIVERSITY OF MIAMI
SCHOOL of EDUCATION & HUMAN DEVELOPMENT

MIT S/DATS TUTORIAL

Website: <http://mis.eng.miami.edu/>

Start webpage

Some demos involved in image processing may take up to 30 seconds to calculate. Please be patient.
You need to install following plugins to run the training demos.

INSTALL NOW WindowsMedia Player 6.0.2.6000

Click here to get onto the main page

Adobe Shockwave or Flush should be installed before use.

You are the visitor to this page.

This web site was created by the support of NSF grants DUE0127290, DUE0632752 and DUE1022750
It is still under construction. All figures and demos are not the final version.

MIS Website: <http://mis.eng.miami.edu/module/mis.php>

1. Home

2. User Login

4. Img Modalities

4. Img Modalities

3. Administrator login

2. User Login

The screenshot shows the MIS website interface. At the top, there is a navigation menu with links for Home, MIS Homepage, Login, Files, CT, MRI, Nuclear Medicine Imaging (NM), Ultrasound, Final Review, and Contact. Below the menu is a search bar and an 'INSTALL NOW' button. The main content area features six image modalities: X-Ray, CT, MRI, NM, Ultrasound, and Final Review. A red box at the bottom of the page contains a warning: 'Some devices involved in image processing may take up to 30 seconds to calculate. Please be patient... You need to install some plugins list in the left to run the training demos.'

1. Home Page: <http://mis.eng.miami.edu/module/home.php>

1.1. Self-Link

1.2. Other BME

1.3. Img Manufac

1.4. Design

1.5. Announcement and contact

The screenshot shows the MIS Home Page. It features a navigation menu with links for Home, MIS Homepage, Other BME Programs, Medical Imaging, Membership, Medical Imaging Simulation, Press Query, Forum, and Contact. Below the menu is a search bar and a 'VISITORS' section. The main content area contains several announcements, including one about the development of the website by NSF grants (DUE072200 and DUE082070), and another about the Summer Internship Program. At the bottom, there is a 'Participating Institution' section with logos for FAU, FIU, Florida International University, and Miami Dade College, and a 'Workshop' section with a logo for the National Science Foundation.

1.2. Link to other BME: <http://mis.eng.miami.edu/Files/SD2-1.pdf>

The screenshot shows a web browser window displaying a table titled "BME program survey based Whitaker Foundation's BMNet web page on URL: http://www.whitaker.org/academic/". The table lists various universities and their BME programs, including columns for "Universities with BME program", "Website", "Undergraduate Courses", "Graduate Courses", "Online Material", and "Online Simulation". A red box highlights the text "Link to Other BMEs" on the left side of the page.

Universities with BME program	Website	Undergraduate Courses	Graduate Courses	Online Material	Online Simulation
1 Alfred University	http://www.alfred.edu/				
2 Arizona State University	http://www.asu.edu/~bme/		Medical imaging instrumentation Medical imaging		
3 Biomedical University	http://www.biomed.ac.uk/		Introduction to Medical Imaging MPhil in Biomedical Sciences Advanced Biomedical Methods in Medical Image Analysis		
4 Boston University	http://www.bu.edu/bme/		Medical Imaging Fundamentals		
5 Case Western Reserve University	http://www.cwru.edu/	Medical Imaging Fundamentals			
6 Catholic University of America	http://www.cua.edu/bme/				
7 City College of New York	http://www.cccny.edu/				
8 Cleveland State University	http://www.csuohio.edu/bme/				
9 Columbia University	http://www.bme.columbia.edu/	Ultrasound in Diagnostic Imaging Biomedical Imaging	Analysis and Quantification of Medical Images		
10 Cornell University	http://www.bme.cornell.edu/		Computer Analysis of Biomedical Images		
11 Creighton University	http://www.bme.creighton.edu/	Imaging I Imaging II			
12 Duke University	http://www.bme.duke.edu/bme220/		Biomedical Imaging Principles of Ultrasound Imaging Modern Diagnostic Imaging Systems		
13 Florida International University	http://www.fiu.edu/	Image analysis in biomedical engineering	Foundations of Medical Image Instruments Current image analysis in biomedical engineering		
14 Florida State University and Florida A&M University	http://www.fsu.edu/bme/		Foundations of Medical Imaging		
15 Georgia Institute of Technology	http://www.gatech.edu/	Diagnostic Imaging Physics			
16 Harvard University - Massachusetts Institute of Technology	http://www.mim.mit.edu/		Principles of Medical imaging		
17 Johns Hopkins University	http://www.bme.jhu.edu/	Concepts of medical imaging	Medical imaging		
18 Johns Hopkins University	http://www.bme.jhu.edu/	Medical Imaging Systems	Advanced topics in medical imaging		
19 Johns Hopkins University	http://www.bme.jhu.edu/				
20 Johns Hopkins University	http://www.bme.jhu.edu/				
21 Johns Hopkins University	http://www.bme.jhu.edu/				
22 Johns Hopkins University	http://www.bme.jhu.edu/				
23 Johns Hopkins University	http://www.bme.jhu.edu/				
24 Johns Hopkins University	http://www.bme.jhu.edu/				
25 Johns Hopkins University	http://www.bme.jhu.edu/				
26 Marshall University	http://www.mu.edu/bme/	Medical Imaging Physics Image Processing for the Biomedical Sciences			

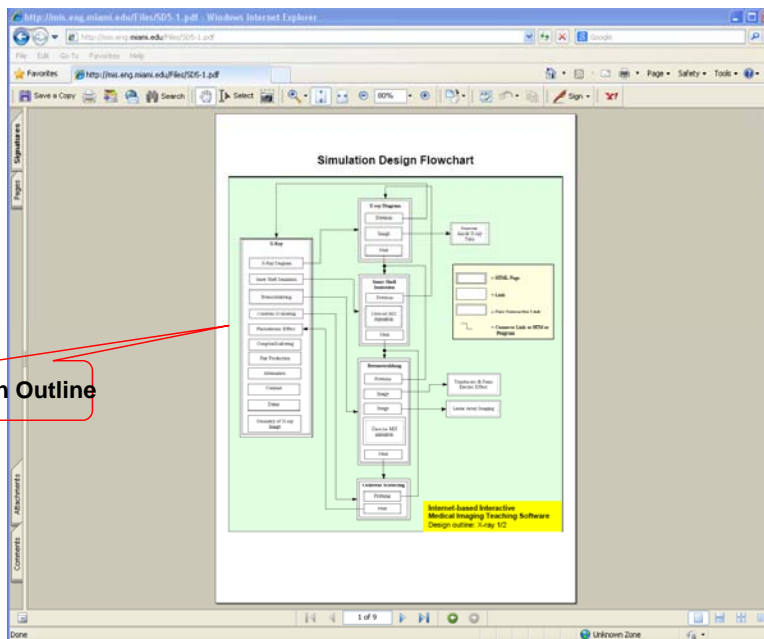
1.3 Link to Img Manufac: <http://mis.eng.miami.edu/Files/SD3-1.pdf>

The screenshot shows a web browser window displaying a table titled "Medical Equipment Manufacturers". The table lists various manufacturers and their products, including columns for "Medical Equipment Manufacturers", "Imaging", "Tutorial", "Simulation", "Comments", and "Website Link". A red box highlights the text "Link to Medical Imaging Manufactures" on the left side of the page.

Medical Equipment Manufacturers	Imaging	Tutorial	Simulation	Comments	Website Link
1 Acuson Medical Diagnostics (AMD)	N	N	N	ECG (obstetrical equipment)	http://www.acuson.com/
2 Acuson Medical Research Corporation	N	N	N	ECG equipment	http://www.acuson.com/
3 Acuson Corp	Y	Y	Y	Various models. One model is regular, 2nd all are same.	http://www.medical_devices.com/whats_new.shtml
4 Advanced Magnetic Inc.	Y	N	N	designs, manufactures and markets contrast agents for use with magnetic resonance imaging (MRI) scans to enhance the imaging of internal organs for the diagnosis of cancer and other diseases.	http://www.advancedmagnetic.com/doc/Products.html
5 Alkermid	Y	N	N	imaging equipment	http://www.alkermid.com/
6 American Medical Design	N	N	N	designs and manufactures ultrasound transducers, probes, and accessories for cardio, medical, and dental applications.	http://www.amdesign.com/
7 Amnicon	Y	N	N	ECG, MRI systems and accessories	http://www.amnicon.com/
8 Amnicon	Y	N	N	3Dx imaging systems	http://www.amnicon.com/
9 Amnicon Associates	N	N	N	3rd and 4th generation processors services for imaging systems.	http://www.amnicon.com/3d.html
10 Amnicon Technology	Y	N	N	manufactures breast imaging system utilizing magnetic resonance imaging (MRI) to assist in early detection and management of breast disease.	http://www.amnicon.com/
11 Amnicon	N	N	N	manufactures systems agents	http://www.amnicon.com/
12 Amnicon	Y	N	N	development and marketing of medical equipment - various business medical education programs, image databases, classroom and product publications	http://www.amnicon.com/3d.html
13 Amnicon	Y	N	N		http://www.amnicon.com/3d.html
14 Amnicon	Y	N	N	offer products incorporating technology platforms in MRI, electronic paramagnetic resonance and MRI.	http://www.amnicon.com/
15 Amnicon	Y	N	N	processor services for MRI equipment	http://www.amnicon.com/3d.html
16 Amnicon	Y	N	N		http://www.amnicon.com/
17 Amnicon	Y	N	N	development and marketing of advanced medical MRI breast imaging systems	http://www.amnicon.com/
18 Amnicon	Y	N	N	medical imaging systems technology for analysis of data based testing for clinical and research life.	http://www.amnicon.com/
19 Amnicon	Y	N	N	digital imaging systems manufacturing	http://www.amnicon.com/
20 Amnicon	Y	N	N	development and deployment of digital imaging and associated technology	http://www.amnicon.com/
21 Amnicon	Y	N	N		http://www.amnicon.com/

1.4. Design Outline: <http://mis.eng.miami.edu/Files/SD5-1.pdf>

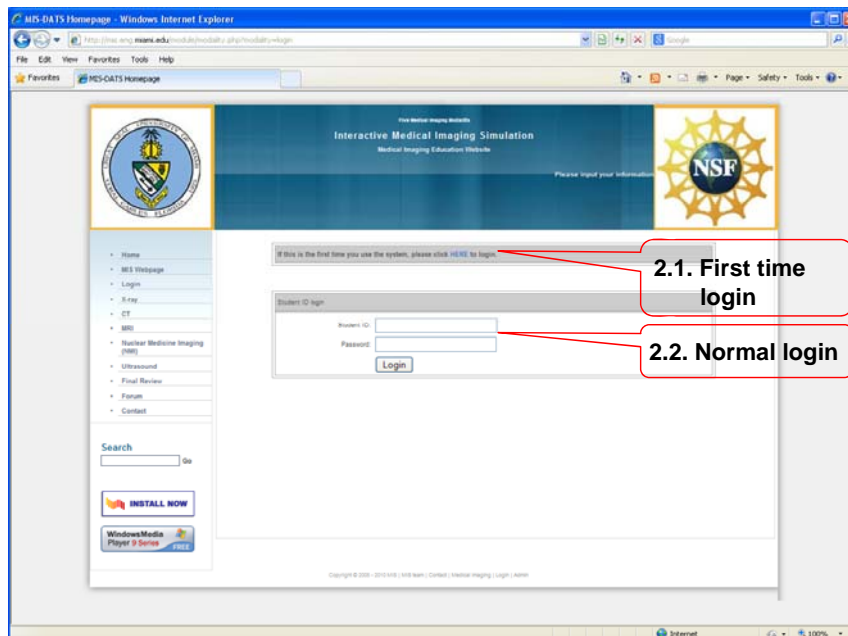
MITS Design Outline



2. Login : <http://mis.eng.miami.edu/module/modality.php?modality=login>

2.1. First time login

2.2. Normal login



1st time Login : <http://mis.eng.miami.edu/module/modality.php?modality=flogin>

2.1. set up user ID and password for future login

2.1. Other information for focused groups

3. Admin Login: <http://mis.eng.miami.edu/admin/m.php>

3.1

3.2

3.3

3.4

3.5

3. Administrator login

3.1. Add Users

**Usr ID: (better specified)
Any character sequence
without space in between
Line break for difference user ID**

**Condition information for
future data retrieval**

3.2.1. User Management

**Check "Use Condition" can extract
users meeting the conditions.
Uncheck "Use Condition" will extract
all previously registered users.**

**Check "Match Case" can extract
specified users ignoring conditions.**

3.2.2. User Management

MIS Management - User Management

Second, you can check the links with the user:
View: View the user's quiz information
Report: Give the whole report of user's performance.
Reset: Reset the user's status to let user change his password if he forgot his login password.
Delete: Delete user and his quiz information

ID	Username	Group	Operation
253	131enrique	Member	View Report Reset Delete
254	131taumin	Member	View Report Reset Delete
255	131therman	Member	View Report Reset Delete
256	131thossein	Member	View Report Reset Delete
257	131tjan	Member	View Report Reset Delete
258	131tkari	Member	View Report Reset Delete
259	131tkeying	Member	View Report Reset Delete
260	131tmiguel	Member	View Report Reset Delete
261	131tsooshin	Member	View Report Reset Delete
262	131thulan	Member	View Report Reset Delete
263	131tyounghun	Member	View Report Reset Delete
264	131tyulu	Member	View Report Reset Delete
267	131therman	Member	View Report Reset Delete

View
Report
Reset
Delete

3.2.3. User Management → View

MIS Management - Quiz Result Information

Score Report

Name	Modality	Module	Time (S)
131enrique	X-Ray	Background	92
131enrique	X-Ray	1	5
131enrique	X-Ray	1	31
131enrique	X-Ray	2	6
131enrique	X-Ray	2	57
131enrique	X-Ray	3	35
131enrique	X-Ray	3	409
131enrique	X-Ray	4	125
131enrique	X-Ray	4	667
131enrique	X-Ray	5	104
131enrique	X-Ray	5	1418248
131enrique	X-Ray	Review	474
131enrique	CT	Background	104
131enrique	CT	1	14
131enrique	CT	1	47
131enrique	CT	2	8
131enrique	CT	2	150
131enrique	CT	3	31
131enrique	CT	3	68
131enrique	CT	4	11

View specified user's "engagement" with the system.

3.2.4. User Management → Report

Output specified user's "performance" In each module.

Name	Gender	Email	College	Major	Status	Ethnicity	Race
131Lenrique	M		UM	BME	Under	Not His	Native
Modality	Module	Start Time	Used Time	Ratio (Cor/Total)	Grade		
X-Ray	Background	10-2-2012 03:55	92	4/5	80		
X-Ray	1	10-2-2012 03:57	5	1/1	100		
X-Ray	1	10-2-2012 03:57	31	1/1	100		
X-Ray	2	10-2-2012 03:58	6	1/1	100		
X-Ray	2	10-2-2012 03:58	57	1/1	100		
X-Ray	3	10-2-2012 03:59	35	1/1	100		
X-Ray	3	10-2-2012 04:00	489	1/1	100		
X-Ray	4	10-2-2012 04:08	125	0/1	0		
X-Ray	4	10-2-2012 04:10	667	0/1	0		
X-Ray	5	10-2-2012 04:22	104	1/1	100		
X-Ray	5	10-2-2012 04:23	1418248	0/1	0		
X-Ray	Review	10-18-2012 14:22	474	4/24	16.6		
CT	Background	10-18-2012 14:30	104	0/6	0		
CT	1	10-18-2012 14:32	14	0/1	0		
CT	1	10-18-2012 14:32	47	0/1	0		
CT	2	10-18-2012 14:33	8	0/1	0		
CT	2	10-18-2012 14:33	150	1/1	100		
CT	3	10-18-2012 14:36	31	0/1	0		
CT	3	10-18-2012 14:37	68	1/1	100		
CT	4	10-18-2012 14:38	11	0/1	0		
CT	4	10-18-2012 14:38	207	0/1	0		
CT	5	10-18-2012 14:42	10	0/1	0		
CT	5	10-18-2012 14:42	27	0/1	0		
CT	6	10-18-2012 14:43	16	0/1	0		

3.2.5. User Management → Reset

When "reset" a user, user ID remains but the user must go through "first time" login to create password.

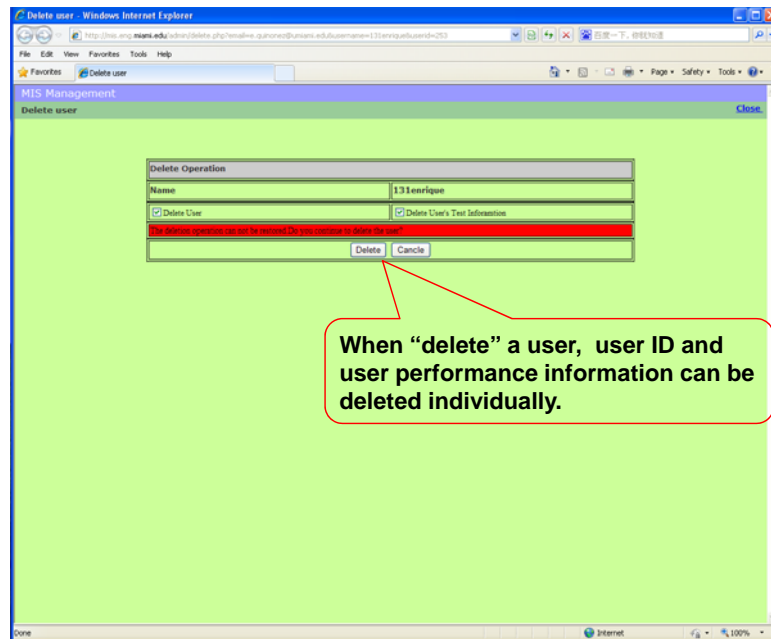
Delete Operation

Name: 131Lenrique

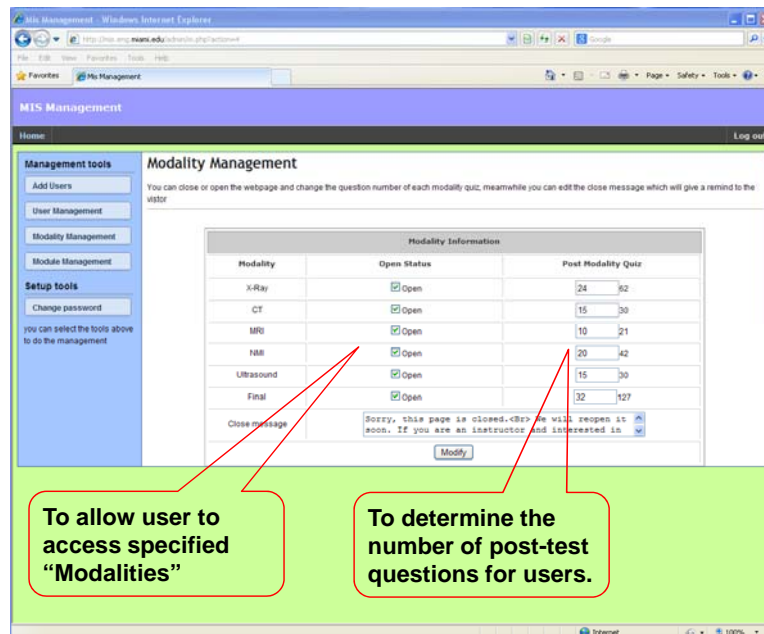
Reset User's Password

Reset Cancel

3.2.6. User Management → Delete



3.3. Modality Management



3.4. Module Management

MIS Management - Windows Internet Explorer

http://msi.mn.edu:8080/mis/management/

MIS Management

Home Log out

Management tools

- Add Users
- User Management
- Modality Management
- Module Management

Setup tools

- Change password

you can select the tools above to do the management

Module Management

Please choose what you want to open or close.

Modality and Module Information				
X-Ray	CT	MRI	NRI	Ultrasound
<input checked="" type="checkbox"/> Review	<input checked="" type="checkbox"/> Review	<input checked="" type="checkbox"/> Review	<input checked="" type="checkbox"/> Review	<input checked="" type="checkbox"/> Physics
<input checked="" type="checkbox"/> Instrumentation	<input checked="" type="checkbox"/> Principle	<input checked="" type="checkbox"/> Magnetic Field	<input checked="" type="checkbox"/> Radiations	<input checked="" type="checkbox"/> Imaging
<input checked="" type="checkbox"/> Radiation	<input checked="" type="checkbox"/> Transformation	<input checked="" type="checkbox"/> Physics of MRI	<input checked="" type="checkbox"/> Nuclear Medicine	
<input checked="" type="checkbox"/> Attenuation	<input checked="" type="checkbox"/> Reconstruction 1	<input checked="" type="checkbox"/> Radio-Frequency	<input checked="" type="checkbox"/> Detection	
<input checked="" type="checkbox"/> Geometry	<input checked="" type="checkbox"/> Reconstruction 2	<input checked="" type="checkbox"/> Reconstruction	<input checked="" type="checkbox"/> Radionuclide	
	<input checked="" type="checkbox"/> Reconstruction 3		<input checked="" type="checkbox"/> Imaging	

Modify

To allow user to access specified "Modules" within each Modality

3.5. Change Password

MIS Management - Windows Internet Explorer

http://msi.mn.edu:8080/mis/management/

MIS Management

Home Log out

Management tools

- Add Users
- User Management
- Modality Management
- Module Management

Setup tools

- Change password

you can select the tools above to do the management

Change Password

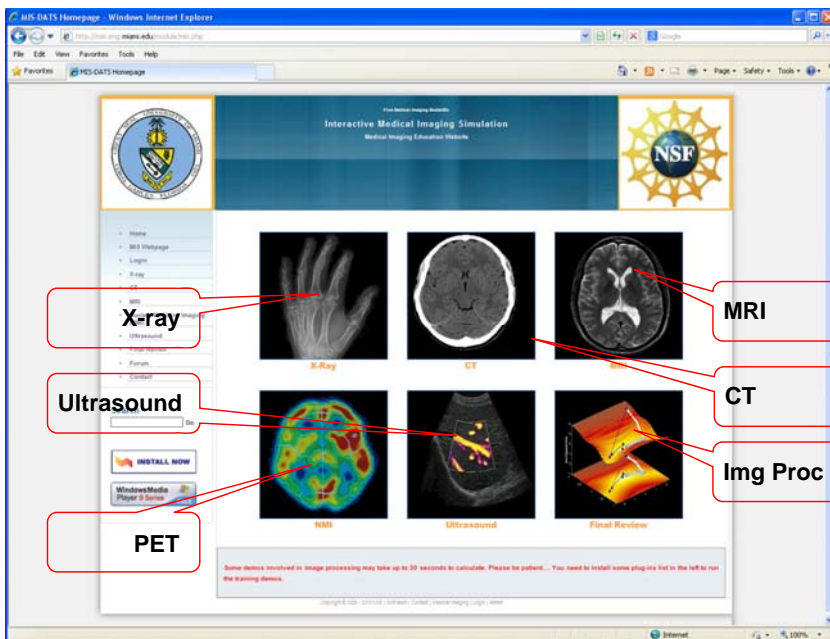
Change password

Input Information	
Old Password	<input type="text"/>
New Password	<input type="text"/>
Repeat New Password	<input type="text"/>

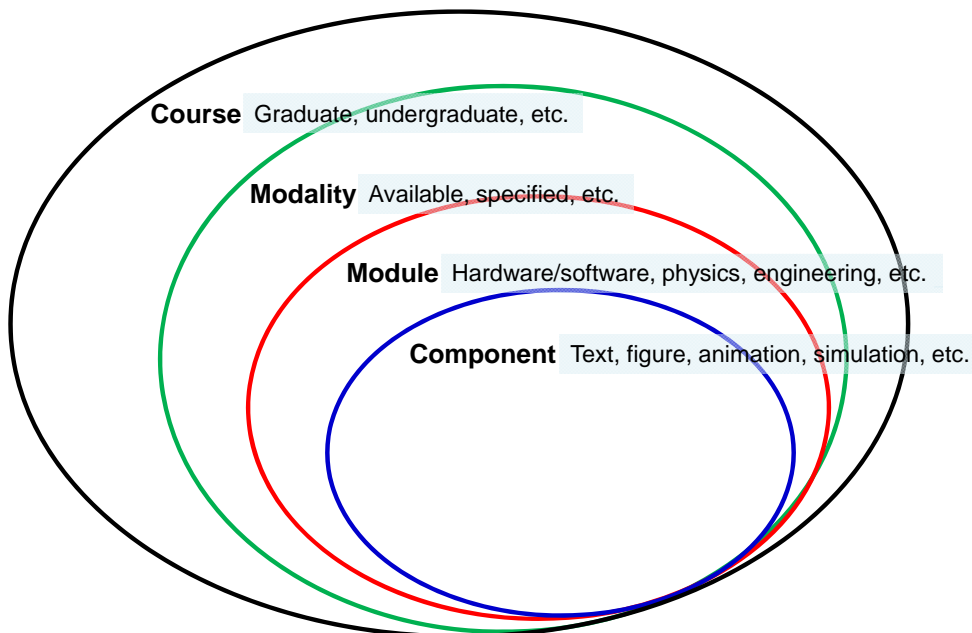
Change

Administrator/Instructor's Password should be changed at the first time login.

4. MIS Website: <http://mis.eng.miami.edu/module/mis.php>



4.1. Hierarchical Design



4.2. Learning Assessment

Pre-Modality Test (4~5 concept questions)

Pre-Module Test (1~2 concept questions)

Module 1

Post-Module Test (1~2 concept questions)

Pre-Module Test (1~2 concept questions)

Module 2

Post-Module Test (1~2 concept questions)

MODALITY 1

Post-Modality Test (10~20 out of ~40 questions)

Final Review Test (40~50 out of ~100 questions)

Module Assessment

Modality Assessment

Course Assessment

4.3. Example

The screenshot shows a web browser displaying the 'Instrumentation of X-ray' module page. The page includes a navigation menu on the left, a main content area with text and a diagram, and a search bar at the bottom. Red callout boxes with arrows point to specific elements: 'Modality' points to the navigation menu, 'Module' points to the 'Module 2: Instrumentation' link, 'Text component' points to the introductory text about X-ray production, and 'Fig component' points to the diagram of an X-ray tube.

Modality

Module

Text component

Fig component

X-Ray Modality
Instrumentation of X-ray
Module 2

Home
MIS Webpage
Logout
X-Ray
Module 1: Review
Module 2: Instrumentation
Module 3: Radiation
Module 4: Attenuation
Module 5: Geometry

Search Go

X-Rays Instrumentation

X rays are produced by energy conversion when a fast-moving stream of electrons is suddenly decelerated in the target anode of an X-ray tube.

TUNGSTEN TARGET
ELECTRONS
HEATED TUNGSTEN FILAMENT
COPPER ANODE
EVACUATED ENVELOPE

Heated filament emits electrons by thermionic emission
Electrons are accelerated by a high voltage.

4.3. Example

Animation component

Component	Function
Cathode (filament)	activate free electrons
Anode (plate)	provide high positive voltage
Grid	low negative voltage

Simplified X-ray tube circuits

4.3. Example

Downloadable Simulation component

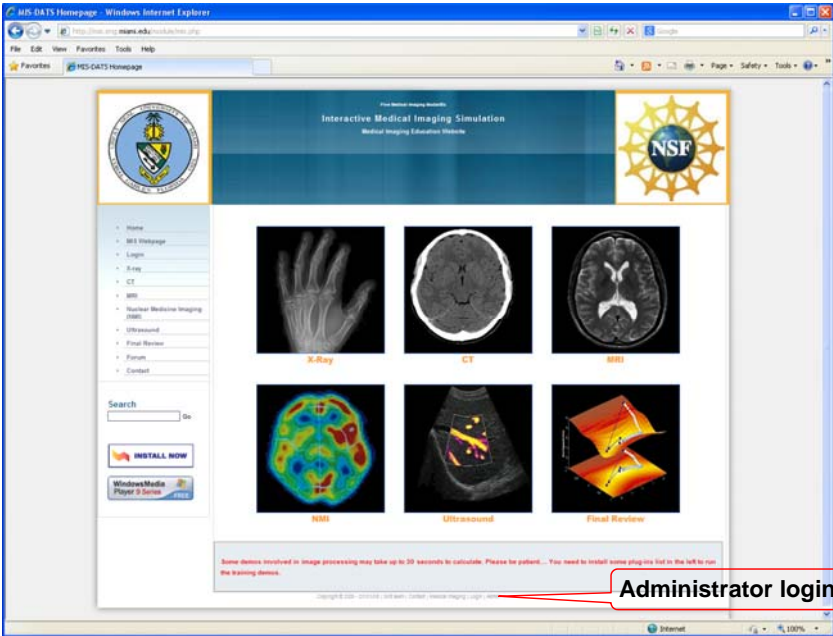
- Reconstruction of MR signal

Fourier transform of three groups of identical nuclei in different magnetic fields

- Example of FID Signal in time domain and frequency domain
 - [MCRInstaller](#)
 - [FIGDemo.ctf](#)
 - [FIGDemo.exe](#)
- Two-dimensional Reconstruction of MR image
 - Generate a gradient magnetic field H (discrete space)
 - Repeatedly apply RF (in Larmor frequency)
 - Capture FID signals
 - Fourier transform

Go through an Imaging Modality

Step 1: Administrator Login



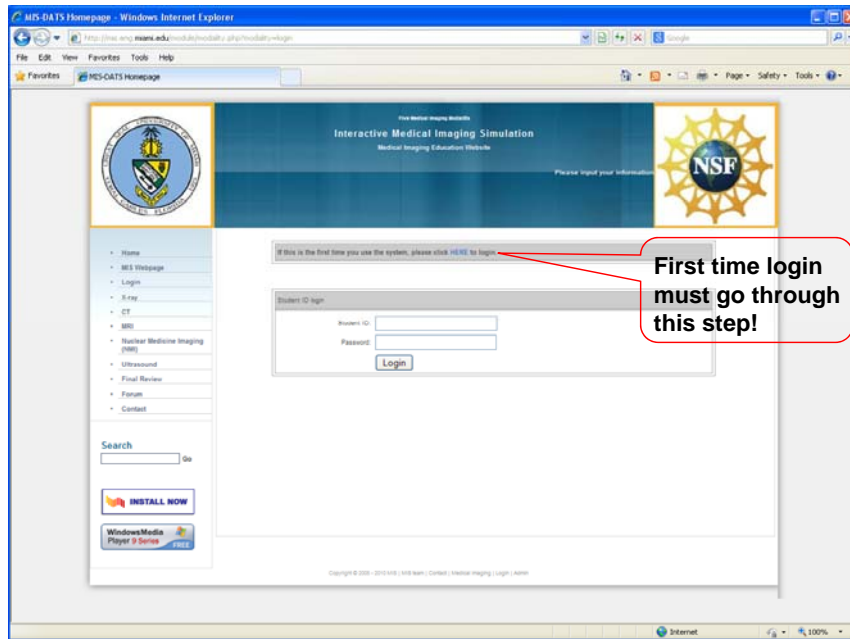
Step 2: Create User Account

The first screenshot shows the administrator login page with a text box for the administrator name and a password field. A red callout box labeled "Administrator login" points to the password field. The second screenshot shows the "Add Users" page with a "Add user" button. A red callout box labeled "Add user" points to this button. The third screenshot shows the "Add Users" page with a "Log out" button in the top right corner. A red callout box labeled "Log out when done" points to this button.

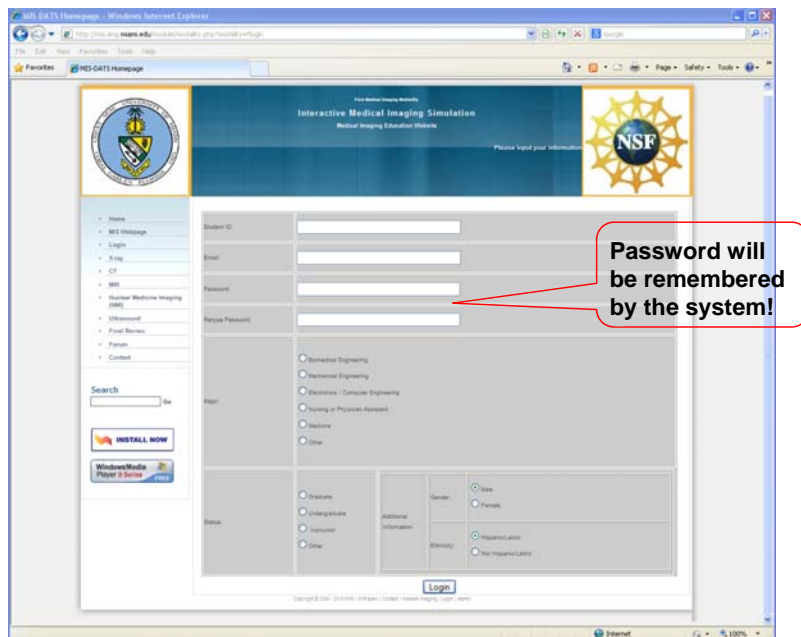
Step 3: User Login

The screenshot shows the HIS-DATS homepage in a Windows Internet Explorer browser. The page features a navigation menu on the left with a "User login" link highlighted by a red callout box. The main content area displays "Interactive Medical Imaging Simulation" with logos for the university and NSF. Below the header are six image thumbnails for different modalities: X-Ray, CT, MRI, PET, Ultrasound, and Final Review. A red callout box labeled "Or click any Imaging modality" points to the MRI thumbnail. At the bottom, a red warning message states: "Some delays involved in image processing may take up to 30 seconds to calculate. Please be patient... You need to install some plugins list in the left to run the training demo."

Step 3: User Login



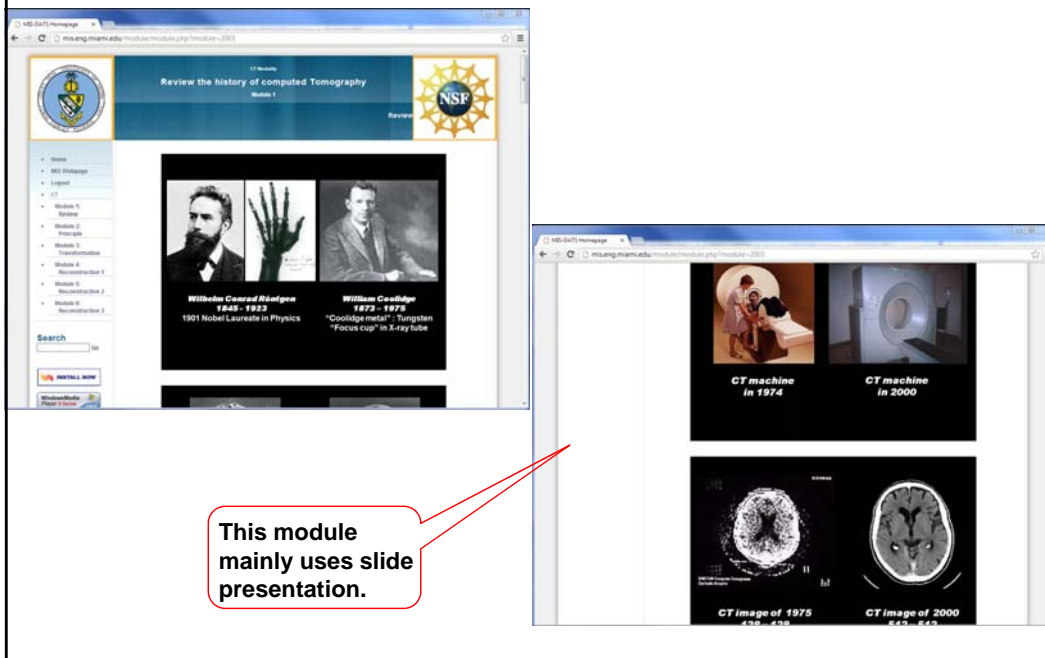
Step 4: User Information



Step 5: Go through CT Modality: Pre-Modality Assessment

Step 6: Go through CT Modality: Pre-Module 1 Assessment

Step 7: Go through CT Modality: Module 1



The screenshot shows the 'Review the history of computed Tomography' module. It features a sidebar with a navigation menu, a main content area with portraits of Wilhelm Conrad Röntgen and William Coolidge, and a grid of images showing CT machines from 1974 and 2000, along with corresponding CT scans from 1975 and 2000.

CT Modality: Review the history of computed Tomography

William Conrad Röntgen 1845 - 1923
1901 Nobel Laureate in Physics

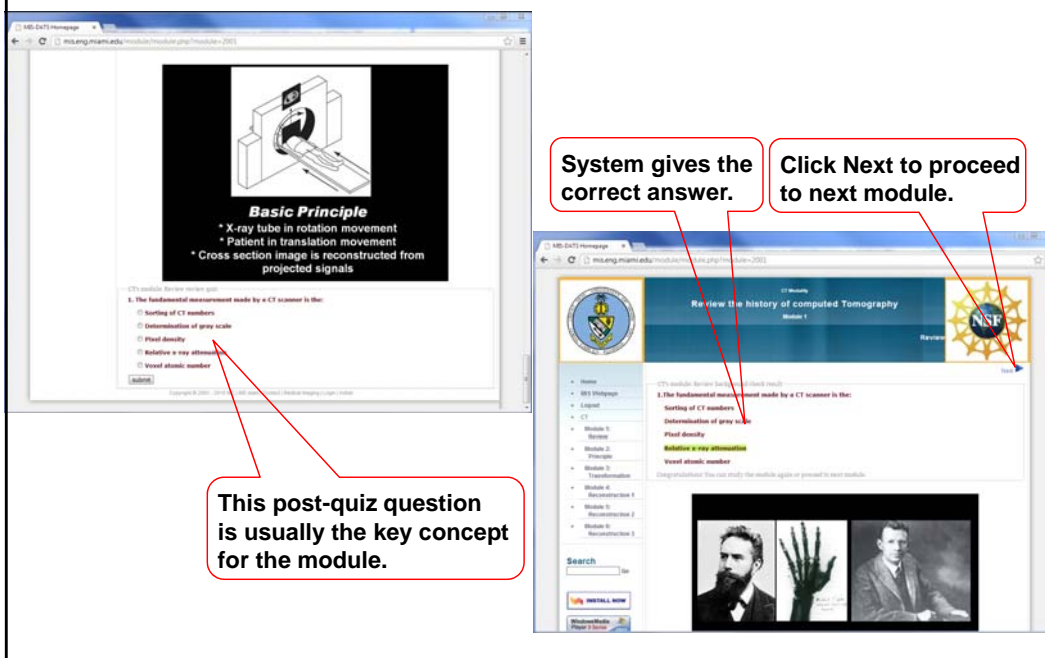
William Coolidge 1872 - 1975
"Coolidge metal" - Tungsten "Focus cup" in X-ray tube

CT machine in 1974 **CT machine in 2000**

CT image of 1975 **CT image of 2000**

This module mainly uses slide presentation.

Step 8: Go through CT Modality: Post-Module 1 Assessment



The screenshot shows the 'Basic Principle' section of the assessment. It includes a diagram of a CT scanner, a list of multiple-choice questions, and a 'Next' button. Red callouts highlight the 'Next' button and the correct answer.

Basic Principle

- * X-ray tube in rotation movement
- * Patient in translation movement
- * Cross section image is reconstructed from projected signals

1. The fundamental measurement made by a CT scanner is the:

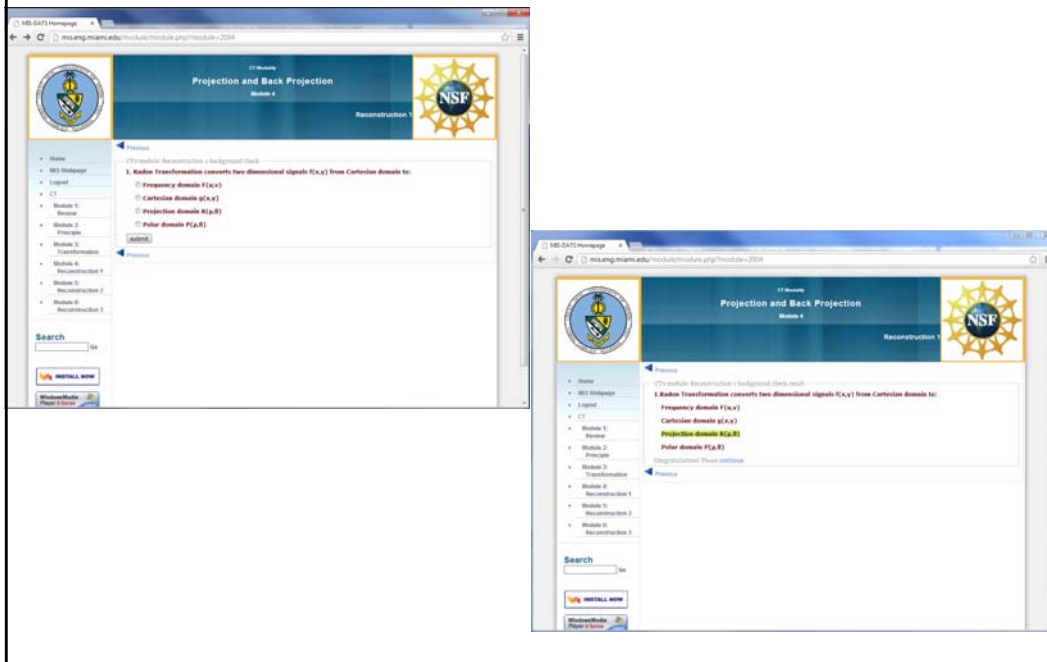
- Sorting of CT numbers
- Determination of gray scale
- Pixel density
- Relative x-ray attenuation
- Voxel atomic number

System gives the correct answer.

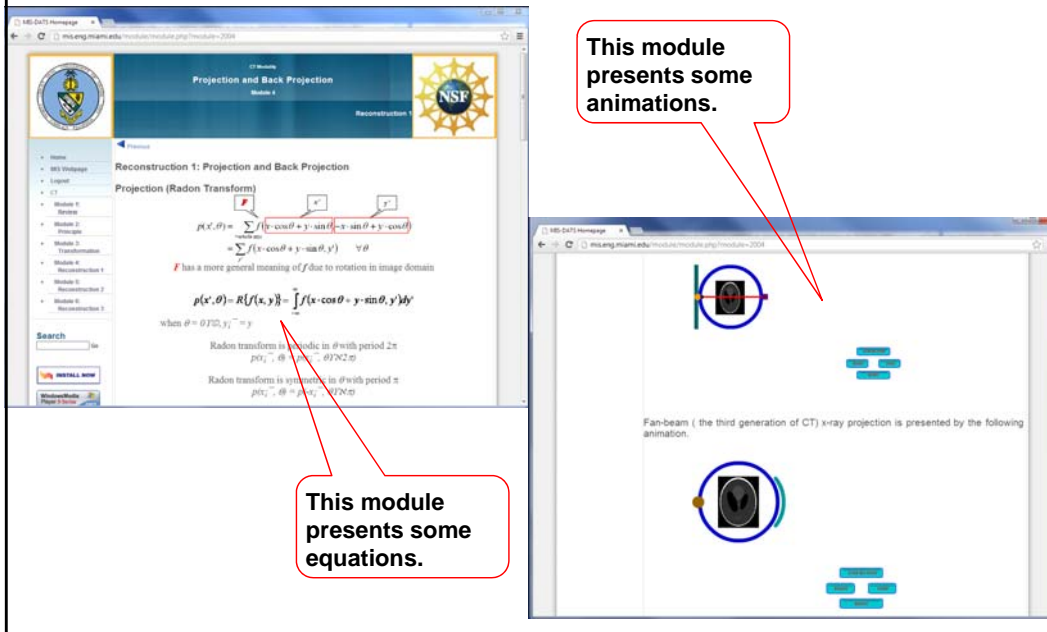
Click Next to proceed to next module.

This post-quiz question is usually the key concept for the module.

Step 9: Go through CT Modality: Pre-Module 4 Assessment



Step 10: Go through CT Modality: Module 4



Step 11: Go through CT Modality: Module 4 (Projection)

CT projection animations (pen-beam and fan-beam) can be played directly.

Fan-beam (the third generation of CT) x-ray projection is presented by the following animation.

Step 12: Go through CT Modality: Module 4 (Back Projection)

CT back projection animations (coordinate-based and angle-based) can be played directly.

Back projection reconstruction can also be realized by checking every degree in teh Radon coordinate followed by every coordinate in the Cartesian coordinate.

Step 13: Download Executable Simulation created by MatLab

MIS-OATS Homepage

mis.eng.miami.edu/module/module.php?modality=CT&module=2004

Download links:

- [MCRInstaller](#)
- [FIDDemo_of](#)
- [FIDDemo.exe](#)

Example of downloadable software simulation created by MatLab codes: MRI FID Signal in time domain and frequency domain. You need 1) download following three files and save them in the same folder; 2) run MCRInstaller first; and 3) run FIDDemo.exe

Example of downloadable software simulation created by MatLab codes: MRI data acquisition and reconstruction simulation. You need 1) download following four files and save them in the same folder; 2) run MCRInstaller first if this is the first time you run this type simulation; and 3) run project_MRI.exe

Download links:

- [MCRInstaller](#)
- [project_MRI_of](#)
- [project_MRI.exe](#)
- [Phantom_Brain_smp_image_pic1_save_target_as...](#)

Simulation created by MatLab codes has been converted to executable applications.

Step 14: Executable Simulation (FID)

FIDDemo

The Matrix

a1	a2	a3
a4	a5	a6
a7	a8	a9

Sampling time: 1000

Base freq: 0

HINT: normally, freq gradient+base freq

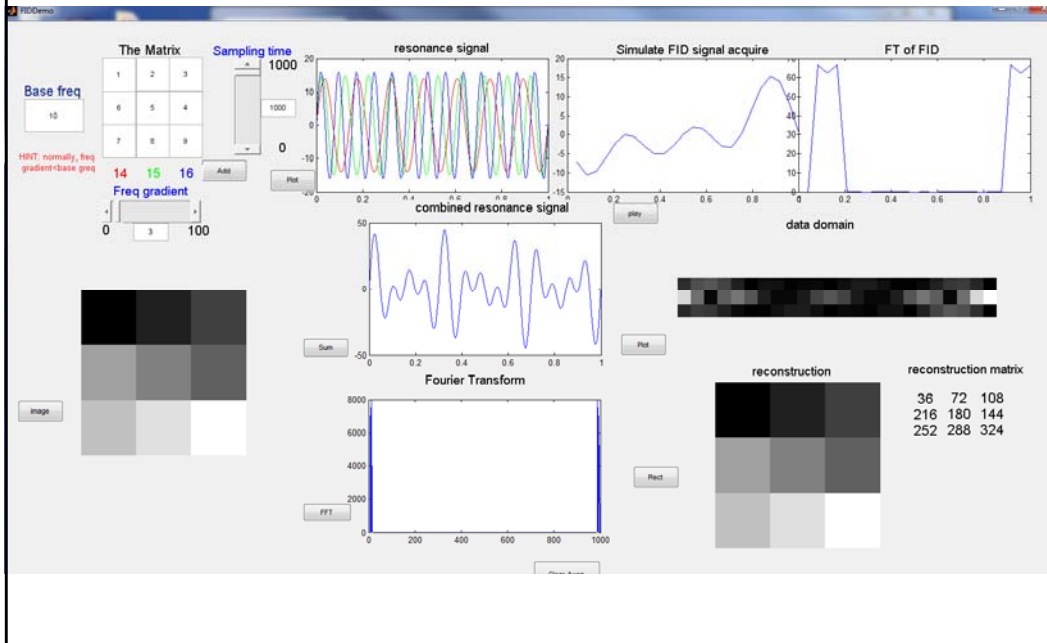
S1 S2 S3

Freq gradient: 0 100

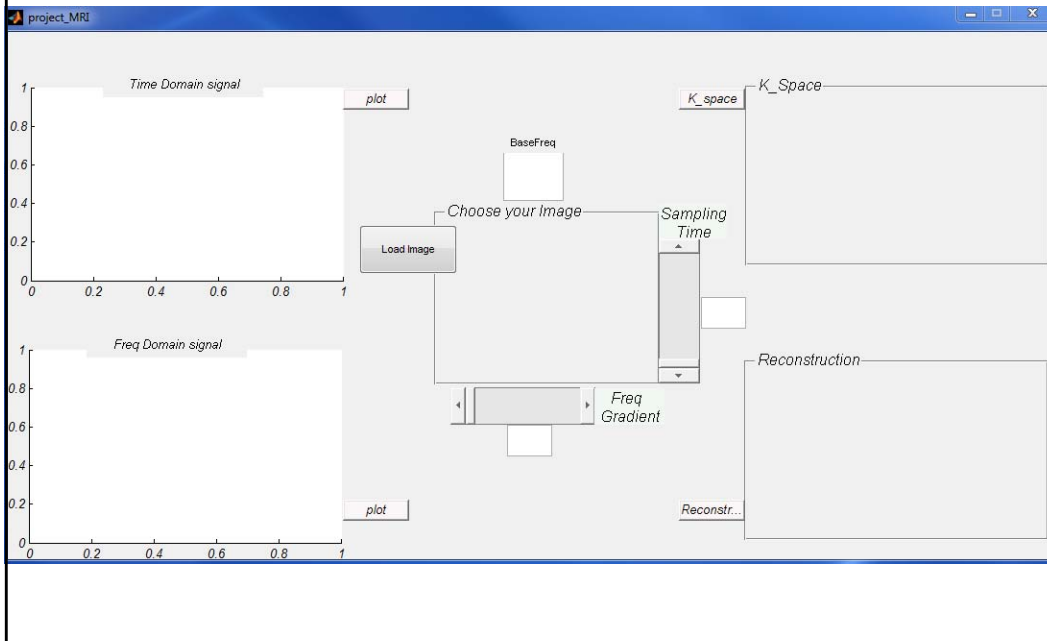
Plots:

- resonance signal
- Simulate FID signal acquire
- FT of FID
- combined resonance signal
- data domain
- reconstruction
- reconstruction matrix
- Fourier Transform
- image

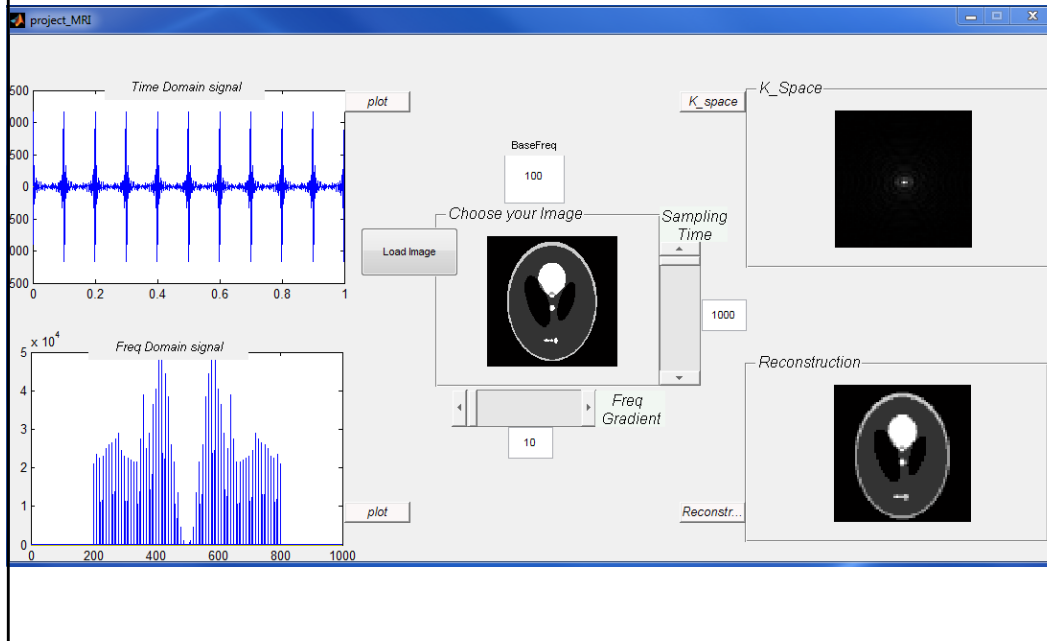
Step 15: Executable Simulation (FID)



Step 16: Executable Simulation (MRI)



Step 17: Executable Simulation (MRI)



Step 18: Go through CT Modality: Post-Modality Assessment

The screenshot shows a web browser window with the URL `mis.eng.miami.edu/module/module.php?module=2006`. The page content includes the instruction: "9). Repeat from step 2, until all the errors between new projections and the original projections are less than a given limit ϵ ." Below this is a section titled "Numerical Animation:" featuring a central image of a brain scan with the text "The procedures of Iterative Reconstruction" and a "Start" button. At the bottom, a message states: "weizhao, you have finished CT Modality. Before you can start a new imaging modality, you have to take a review test. Please click the following link to do the quiz." with a "CT Review" link. Two red callout boxes are present: one on the left pointing to the "Start" button with the text "This box will always stay here when all modules are learned.", and one on the right pointing to the "CT Review" link with the text "Assess student's learning gain after learning this modality."

Step 19: Go through CT Modality: Post-Modality Assessment

Every question must be answered to complete the assessment.

Deficits? Answers are not provided to user but to Instructor.

Interactive Medical Imaging Simulation
Medical Imaging Education Website

CT Background check

welshon, Please finish all 2 parts of quiz. It includes 15 questions, will only need 3 to 7 minutes!

Please attention, during the quiz, you can not use 'back button' of IE, otherwise the web page will expire and you can not access these questions again!

1. The theoretically best possible CT resolution for a 512² matrix and 25 cm FOV is:

A. 0.5 lp/cm
 B. 1.0 lp/cm
 C. 2.0 lp/cm
 D. 3.0 lp/cm
 E. 16.0 lp/cm

2. Which of the following is not a source of CT artifacts?

A. Patient motion
 B. Metal implants
 C. Beam hardening

11. Which would not likely be used as detectors in CT scanners?

A. Sodium germanate
 B. CsBr₃
 C. Xenon gas
 D. NaI
 E. Air ionization chambers

12. Which image reconstruction algorithm is used in current commercial CT scanners?

A. Two-dimensional Fourier transform
 B. Three-dimensional Fourier transform
 C. Back projection

Step 20: Track Student Performance

Log out first

Then administrator login

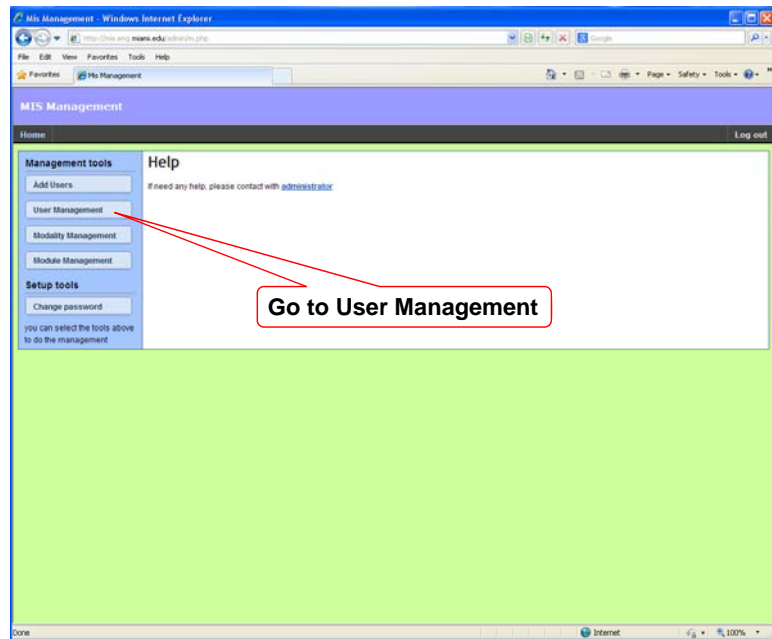
HIS-GATS Homepage - Windows Internet Explorer

Interactive Medical Imaging Simulation
Medical Imaging Education Website

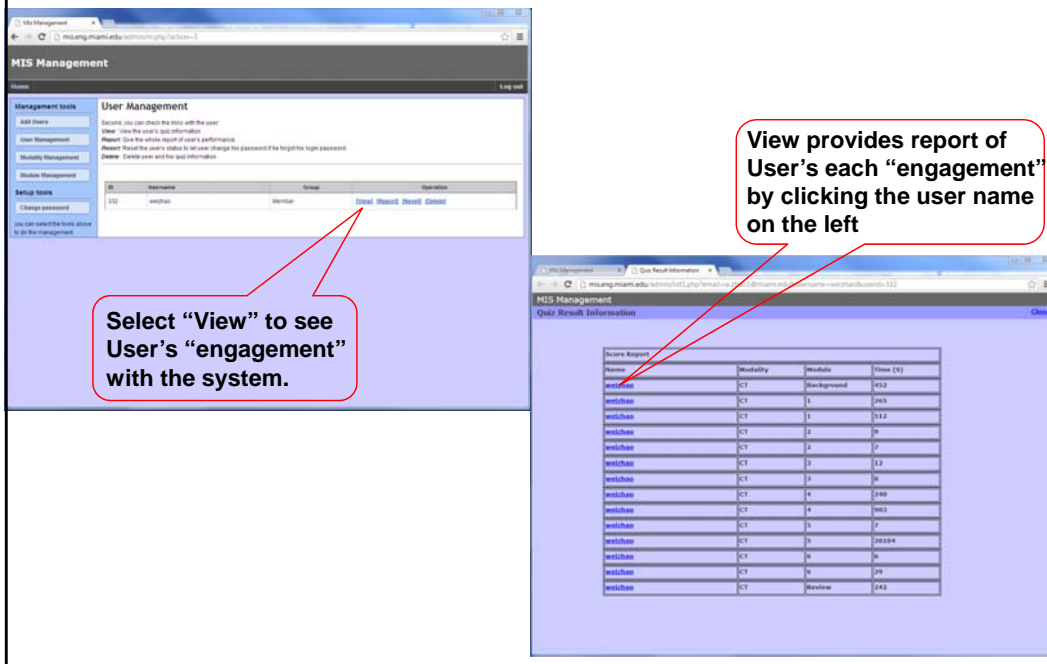
X-Ray CT MRI SPECT Ultrasound Final Review

Some delays involved in image processing may take up to 30 seconds to calculate. Please be patient... You need to install java plugin for the left to run the training demo.

Step 20: Track Student Performance



Step 21: Track Student Performance



Step 22: Track Student Performance

Performance on assessment questions for Pre-post Modality and Pre-post Module are reported here.

Left column is user's answers. Right column is correct answers.

Left column is user's answers. Right column is correct answers.

Question ID	Question Text	User Answer	Correct Answer
10	The resolution of CT image has not been changed since the first generation CT scanner was developed.	True	False
11	The fundamental measurement made by a CT scanner is the:	Relative x-ray attenuation	Relative x-ray attenuation
14	For the 1 st generation CT, the attenuation information on each pixel is received from an exponential non-linear system.	False	True
16	Function F's Fourier transformation is F, function G's Fourier transformation is G, so the convolution of F and G ((F*G) maps to the multiplication (FG) of F and G.	True	True
19	Which material has the highest ultrasound propagation velocity?	Air	Metal
24	Which image reconstruction algorithm is used in current commercial CT scanners?	Two dimensional Fourier transforms	Filtered back projection
17	The theoretically possible CT resolution for a 512 ² matrix and 25 cm FOV is:	2.8 lp/mm	1.8 lp/mm
27	Which of the following is not a source of CT artifacts?	Beam hardening	Low tube current
3	Beam characterization is difficult because the value of a CT number may change because of:	Tube current	Volume averaging
29	The dose to the fetus during an abdominal CT scan would not increase if:	Tube current	Patient size
13	Fourth generation CT detectors are frequently made of:	CdWO ₄	CdWO ₄
18	CT collimators are:	Usually made out of Platinium	Variable for different section thickness
28	Representative patient doses to CT are expected to include all the following except:	Body central axis dose of 80 mSv (4 rad)	Body central axis dose of 40 mSv (4 rad)
14	CT fluoroscopy minimizes radiation doses by using lower:	Current	Current

Step 23: Track Student Performance

Select "Report" to see User's numerical data with the system.

Name	Gender	email	College	Major	Status	Eligibility	Score
weidhan	M	w_eidhan3@student.miami.edu	SOB	BSME	Under	Not vls	Not/No
Modality	Module	Start Time	End Time	Score	Max (Cor/Total)	Grade	
CT	Background	06-13-2013 09:45	452	176	18.8		
CT	1	06-13-2013 09:52	265	302	0		
CT	2	06-13-2013 10:04	213	302	0		
CT	3	06-13-2013 10:20	0	171	1000		
CT	4	06-13-2013 10:20	2	171	1000		
CT	5	06-13-2013 10:20	12	171	1000		
CT	6	06-13-2013 10:21	0	302	0		
CT	7	06-13-2013 10:21	290	302	0		
CT	8	06-13-2013 10:24	363	302	0		
CT	9	06-13-2013 10:43	2	171	1000		
CT	10	06-13-2013 10:43	28194	302	0		
CT	11	06-13-2013 10:52	0	302	0		
CT	12	06-13-2013 10:52	29	302	0		
CT	Review	06-13-2013 10:54	243	1713	6.8		

- **Administrator is a “User”**
- **Modalities are “Parallel”**
- **Modules are “Sequential”**
- **User Manual is attached**
- **System will be updated continuously**
- **Correction and revision are welcome**
- **New development are very much welcome**

Instruction to MITS/DATS online courseware

MITS: Medical Imaging Teaching Software
DATS: Dynamic Assessment Tracking System

MITS/DATS is designed for medical imaging education as an online courseware that is particularly used under a hybrid teaching/learning environment. The courseware consists of five commonly used medical imaging modalities (X-ray, CT, MRI, PET, and Ultrasound) and commonly used image processing tools (under construction). Each imaging modality consists of six basic components to deliver knowledge to students, 1) text description, 2) figure/picture/image illustration, 3) interactive animation, 4) interactive simulation, 5) pre-post assessment and 6) library of medical imaging application (under construction). Each imaging modality in MITS contains several teaching modules (teaching/learning topics). DATS is a database under MySQL environment. DATS is the “manager” of MITS. DATS controls turning on/off modalities, modules, assessment questions and user enrollment.

Home page: <http://mis.eng.miami.edu/module/home.php>,

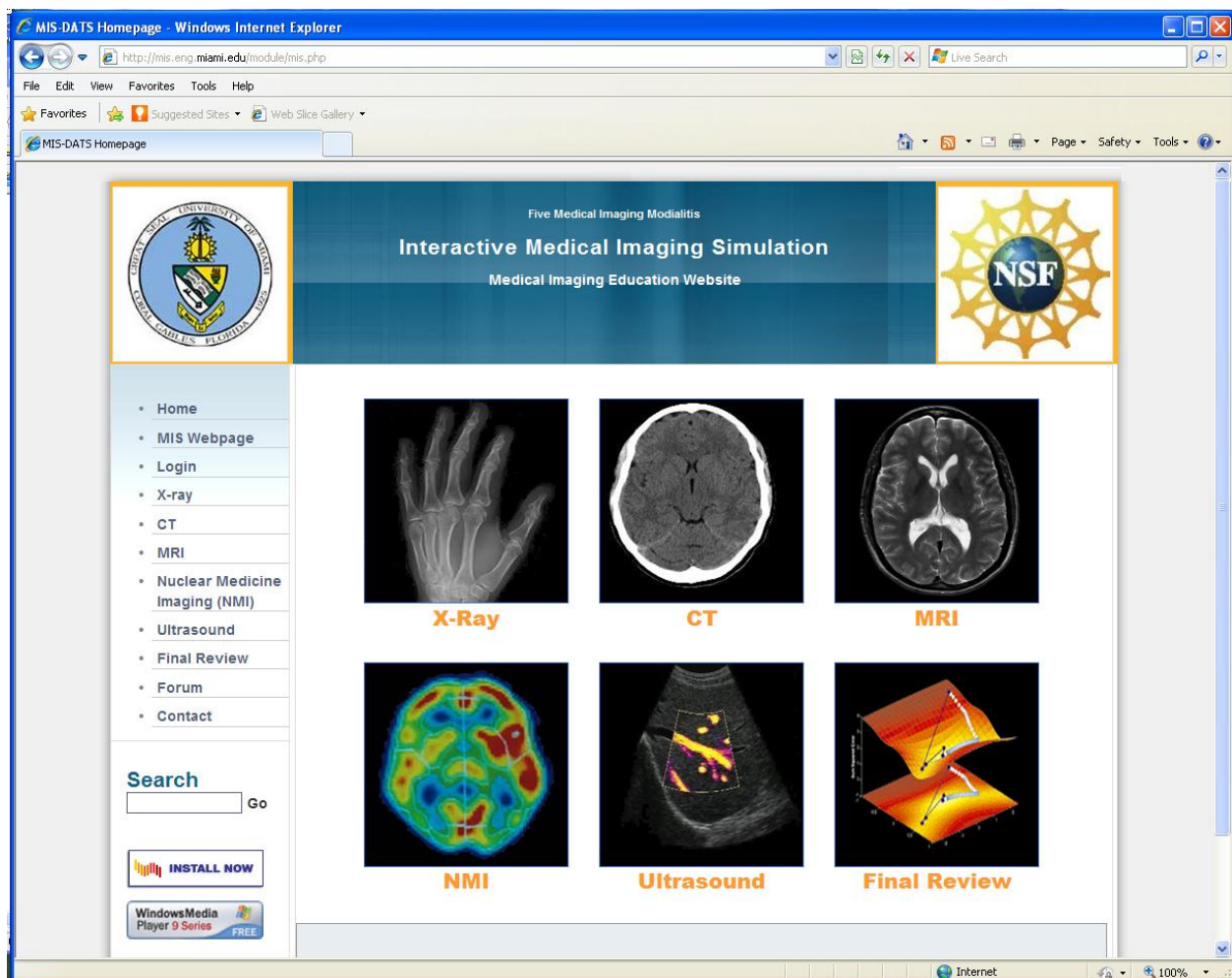
The screenshot shows the MIS-DATS Homepage in a Windows Internet Explorer browser window. The address bar displays <http://mis.eng.miami.edu/module/home.php>. The page layout includes a navigation menu on the left with links for Home, MIS Webpage, Other BME Programs, Medical Imaging Manufacturers, Medical Imaging Simulation Flow Charts, Forum, and Contact. Below the menu is a search bar and a visitor counter showing 002111. The main content area features a header with the University of Miami logo, the text "Five Medical Imaging Modalities", "Interactive Medical Imaging Simulation", and "Medical Imaging Education Website", and the NSF logo. The "Announcement" section, posted by Dr. Zhao, describes the development of MITS supported by NSF grants and provides contact information for Dr. Zhao. The "Intern Students" section, also posted by Dr. Zhao, offers summer or winter internships and provides information about the application process.

On the home page, we provide
Links to Other BME Program in USA (updated 2009)
Links to Medical Imaging Manufactures (updated 2009)
Links to Imaging Simulation Flow Charts (updated 2008)

Announcement: updating news for MITS/DATS
Intern Students: application for internship
Participating Institution: application as a user-institution
Faculty Workshop: application for attending NSF-funded workshop

From the home page to the MITS page, either click the [MIS Webpage](#) or enter the MITS address <http://mis.eng.miami.edu/module/mis.php>

see captured screen:



Note that the MIS link is a webpage under the MITS/DATS home page

Login as Administrator/Instructor

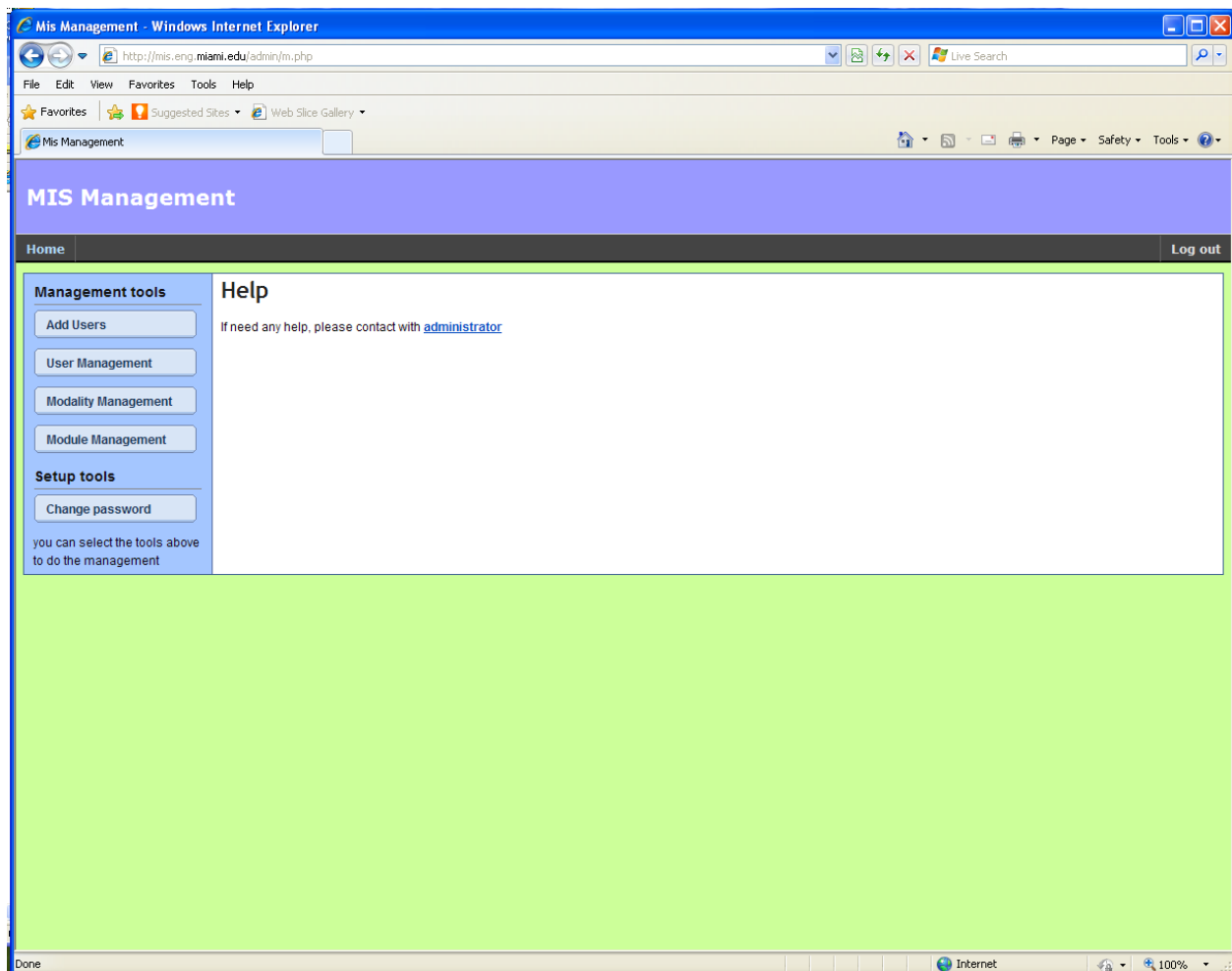
Go to the **bottom of the page** (home page or MIS page)

Copyright © 2005 - 2010 MIS | [MIS team](#) | [Contact](#) | [Medical Imaging](#) | [Login](#) | [Admin](#)

Click “Admin”, enter your username and password, it will link you to the **administrator login page**. Administrator/instructor can do following:

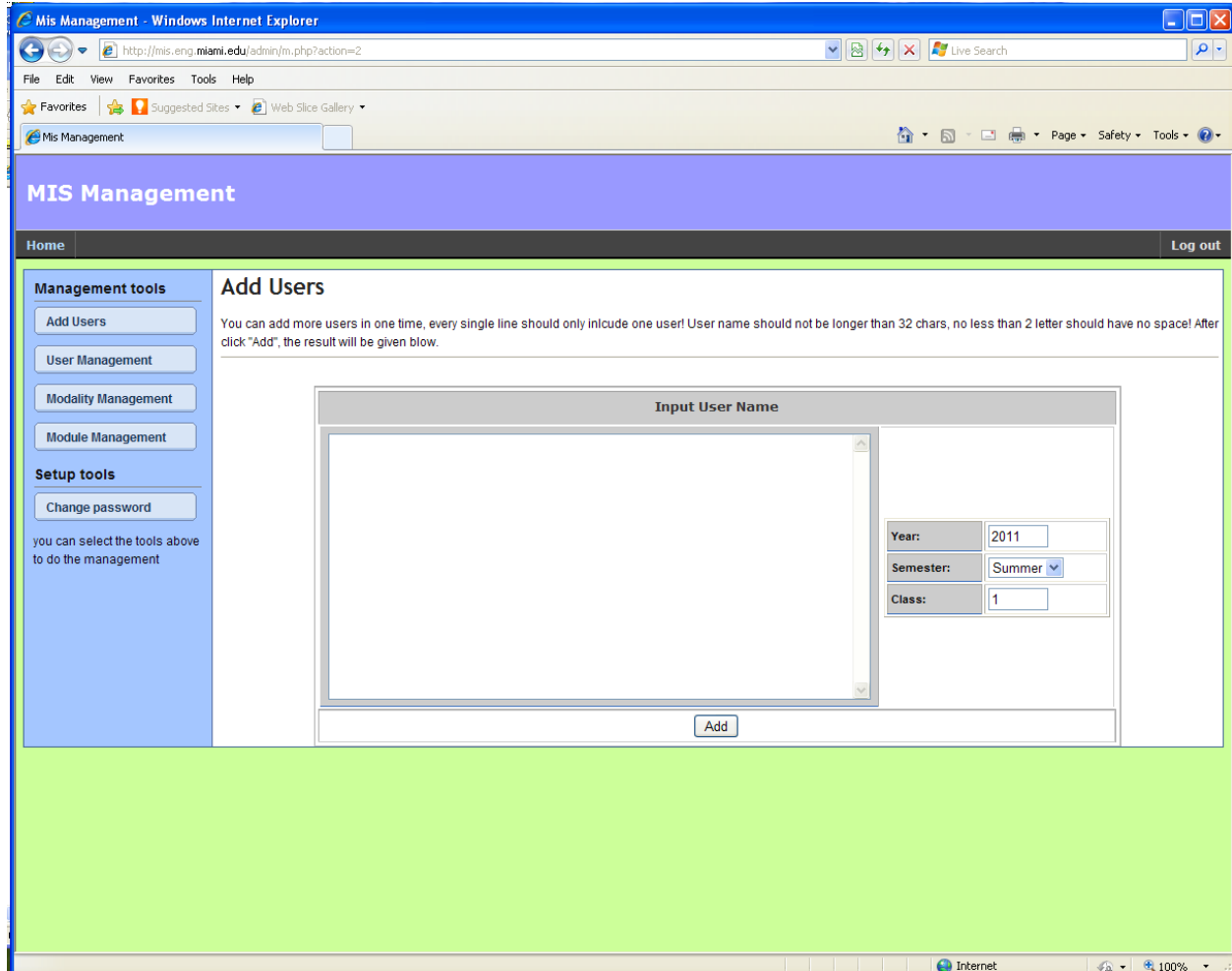
- 1) Add Users
- 2) User Management
- 3) Modality Management
- 4) Module management
- 5) Change Password

The interface is displayed as following:



You can select the tools listed above to manage the system.

Add Users:



Administrator/instructor can add users through the window provided by the system. You should first specify “Year”, “Semester” and “Class” first (for easy future retrieval).

Year is a 4-digit number.

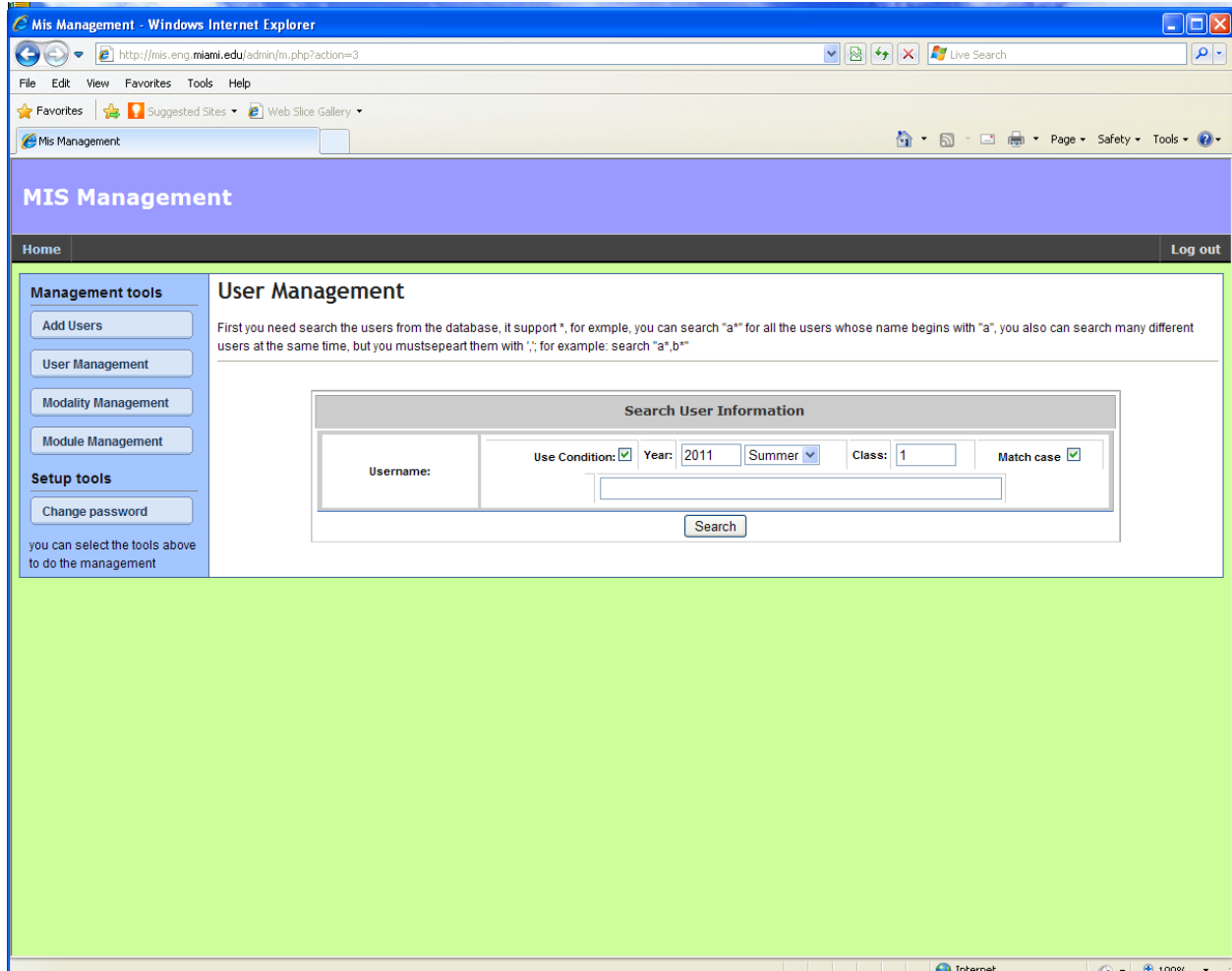
Semester is selected from the dropdown list (Fall, Summer, or Spring).

Class is course code, such as BME300, ECE400.

These entries will be associated with the users for assessment. Administrator/instructor can retrieve user’s performance or engagement through the information.

Username can be entered in the provided window separated by line break (return key) if more than one username entered. Username can be any more-than-two character string. Email address can also be username. Administrator/instructor can enroll multiple users, who belong to the same Year/Semester/Class, in one window/time.

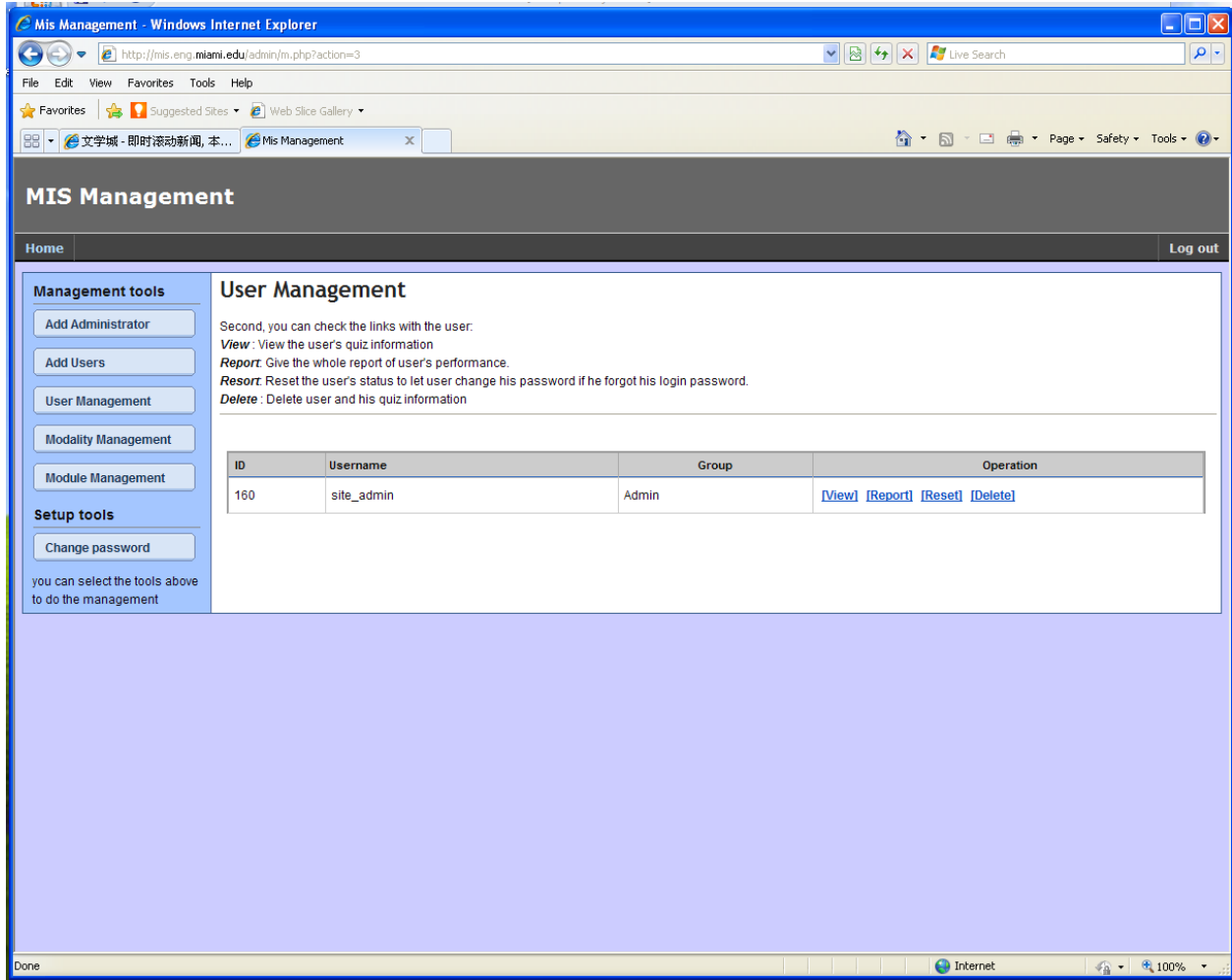
User Management:



In order to manage a user, administrator/instructor must select the user(s) first.

Selecting user(s) can use the “condition” searching provided while enrolling users (year/semester/class) by typing part of the username (or *) in the space, or uncheck the option by typing part of the username (or *). If “Use Condition” is unchecked, the specified user (username) or all users satisfying wildcard * will be displayed.

Once the user(s) is retrieved, administrator/instructor can select a specific user. For example,



ID	Username	Group	Operation
160	site_admin	Admin	[View] [Report] [Reset] [Delete]

Administrator/instructor can do following management to the user:

- View: engagement of the user to MITS/DATS, (duration of login, pre-post test, etc.)
- Report: output user's all information
- Reset: reset user's password to be "blank", when user login, just feel the password
- Delete: remove the user from the database

Modality Management:

This management option is provided to administrator/instructor to control each imaging modality's availability to user (student) in accordance with the teaching/learning progress.

The screenshot shows a web browser window titled "MIS Management - Windows Internet Explorer" with the URL "http://mis.eng.miami.edu/admin/m.php?action=4". The page content includes a navigation menu on the left with options like "Add Administrator", "Add Users", "User Management", "Modality Management", "Module Management", "Change password", and "you can select the tools above to do the management". The main content area is titled "Modality Management" and contains a table of modality information.

Modality Information		
Modality	Open Status	Post Modality Quiz
X-Ray	<input checked="" type="checkbox"/> Open	20 62
CT	<input checked="" type="checkbox"/> Open	13 30
MRI	<input checked="" type="checkbox"/> Open	10 21
NMI	<input checked="" type="checkbox"/> Open	20 42
Ultrasound	<input checked="" type="checkbox"/> Open	15 30
Final	<input checked="" type="checkbox"/> Open	30 127
Close message	<input type="text" value="Sorry, now the page has been closed!
 We will reopen it soon. If you are an instructor and"/> <input type="button" value="Modify"/>	

Administrator/instructor can do following management to the user:

Enable or disable an imaging modality to users (students).

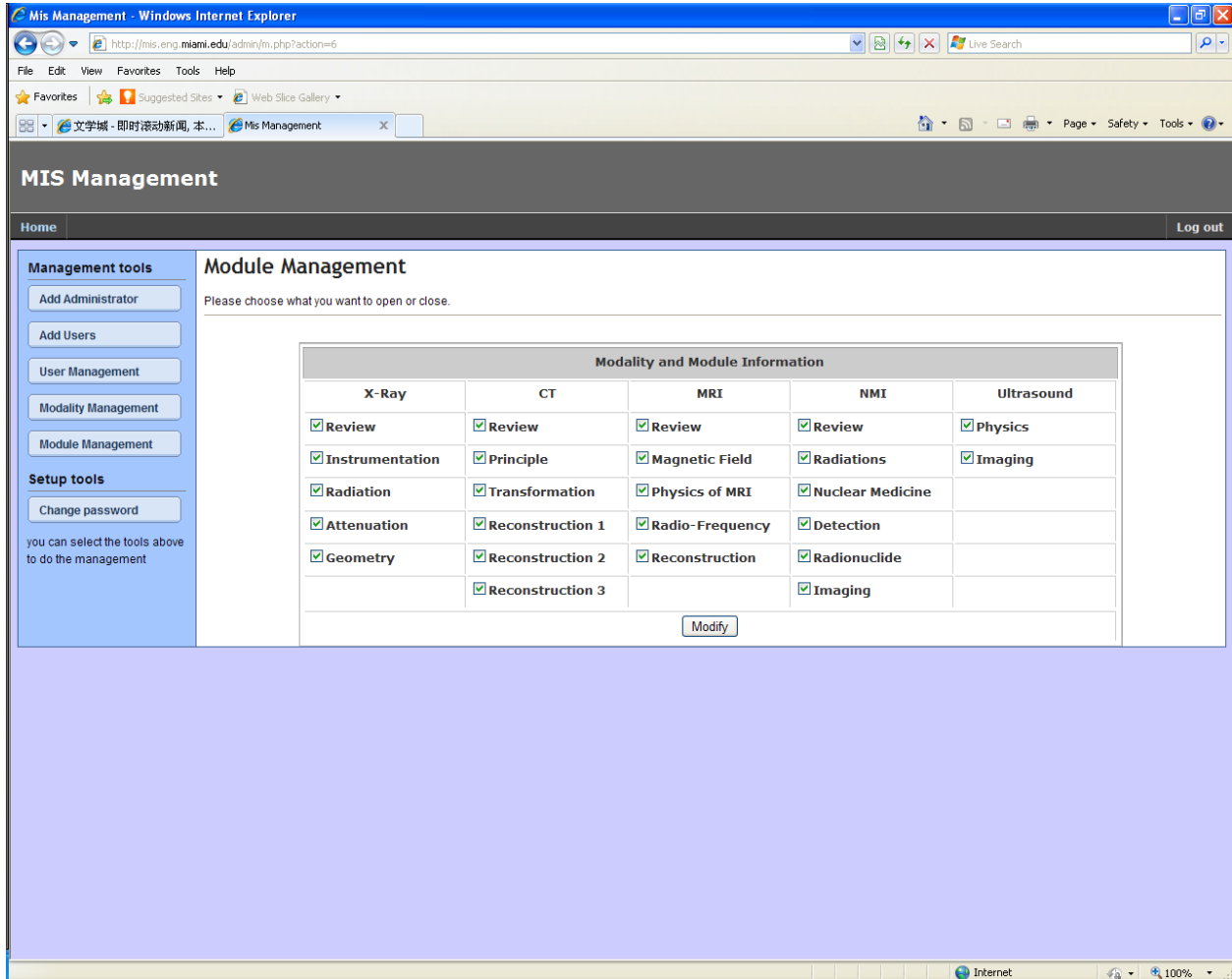
Enter a message to for the closed modality(ies).

Determine the **number of post quiz questions** from the quiz question pools. The number of post quiz questions is the same to each user but not identical because the quiz questions are randomly selected from the question pools.

Add more quiz questions to the question pools (under construction).

Module Management:

This management option is provided to administrator/instructor to control each module (teaching/learning topic) within an imaging modality's availability to user (student) in accordance with the teaching/learning progress. For example, entry level imaging class does not need "reconstruction" modules in the CT modality.



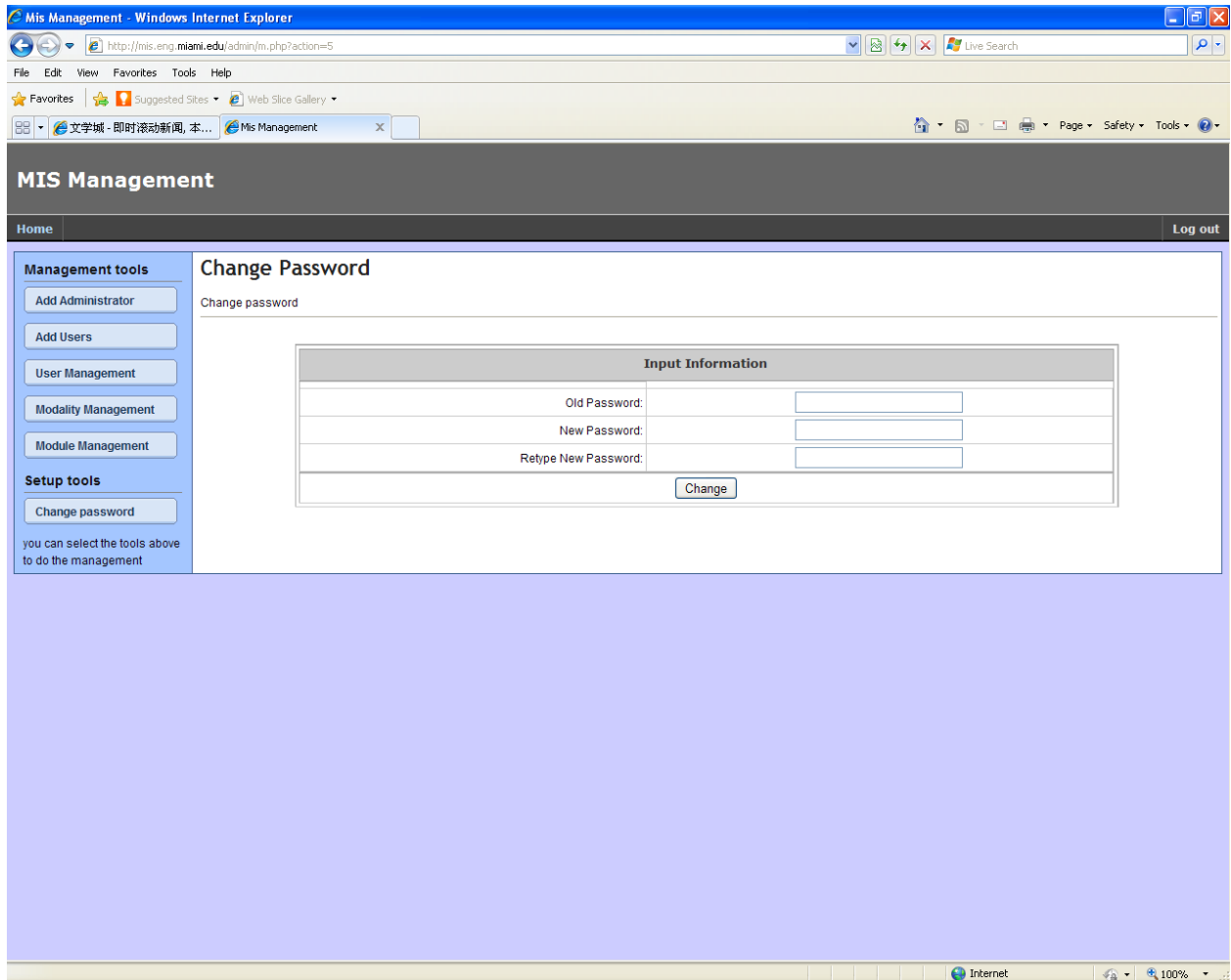
Administrator/instructor can check/uncheck selected modules and then click Modify button.

Please note that "module" is under "modality" so that if the modality is closed, users (students) will not be able to see any module within the modality no matter the module is checked or unchecked.

Change Password:

Administrator/instructor can change his/her own password.

Please note that this function is set for administrator/instructor. A user's password can also be reset. That function is under the "User Management" option.



Login as User

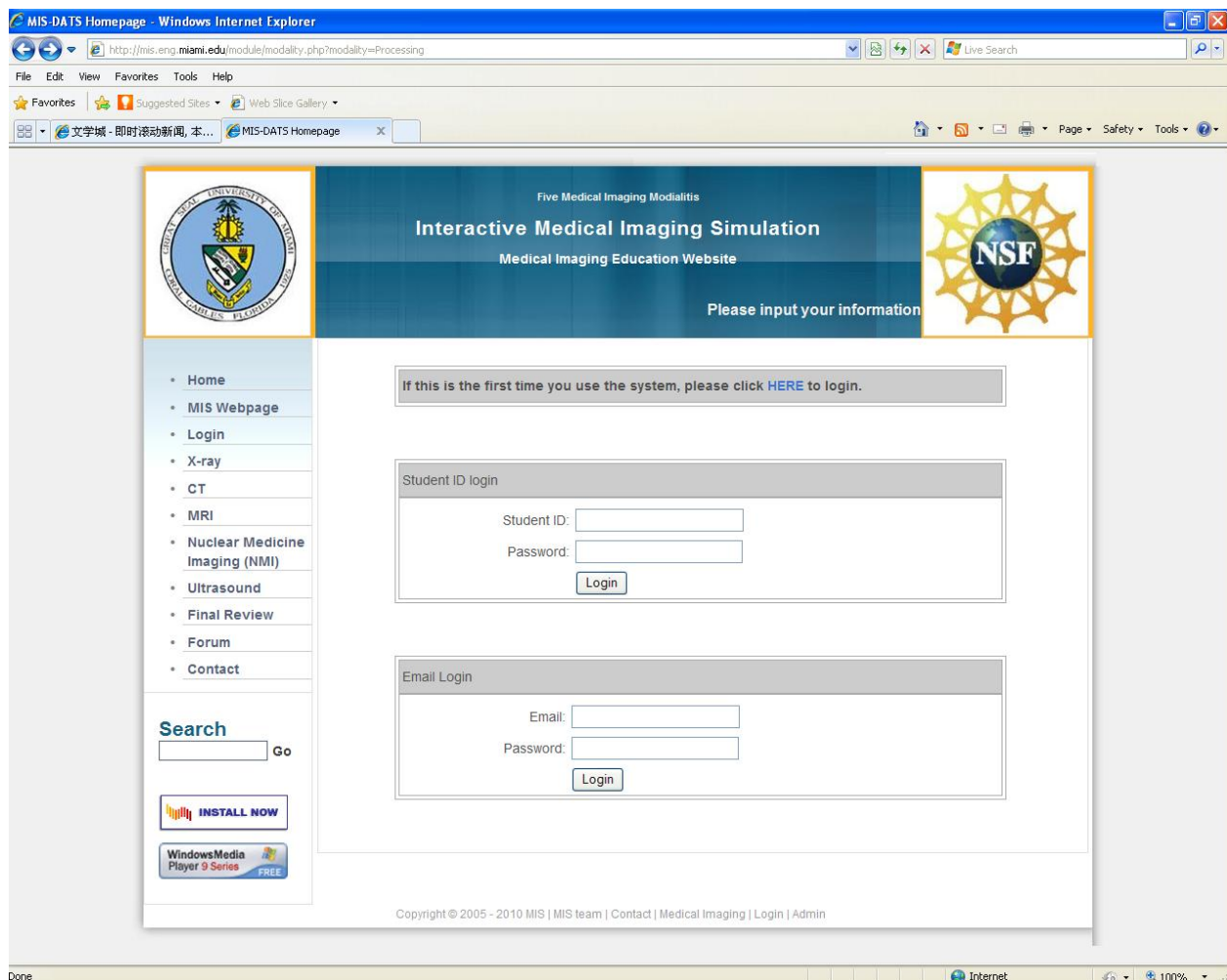
After Administrator/instructor has added a user to the system, the user can login from **two** places

- 1) The “Login” link at the **bottom of the page**

Copyright © 2005 - 2010 MIS | [MIS team](#) | [Contact](#) | [Medical Imaging](#) | [Login](#) | [Admin](#)

- 2) The MIS page: <http://mis.eng.miami.edu/module/mis.php>, click any imaging modality

User will see a login prompt as following:



If this is the first time the user uses MITS/DATS, he/she must click top “HERE” button to setup his/her account (including password). Without this account setup, MITS/DATS will not recognize the user.

The “HERE” button links the account setup prompt window. A first-time user needs to fill in required information.

Student ID is the **username** entered by the administrator/instructor.

A valid email address is required too.

Password is a more than 6-character string.

Other information is self-explained.

The screenshot shows a web browser window displaying the login page for the Interactive Medical Imaging Simulation. The page has a blue header with the site name and a navigation menu on the left. The main content area is a light gray box containing a login form. The form has several sections: a top section with text input fields for Student ID, Email, Password, and Retype Password; a middle section with radio buttons for selecting a Major; and a bottom section with radio buttons for selecting a Status, Gender, and Ethnicity. A 'Login' button is located at the bottom of the form. The browser's address bar shows the URL: http://mis.eng.miami.edu/module/modality.php?modality=flogin.

Once the user sets up his/her account, he/she can use **the username (student ID) with the same password to login**. Student ID login is to use the username to login. The password is the same for both. If he/she forgets the password, the administrator/instructor can go to “User Management” to “Reset” his/her password. Password becomes blank now! The user can then simply enter his/her username or email and fill in a new password to login.

Please note that **Administrator/instructor is also a User**. Following description is applied any user. A simple practice is that the administrator/instructor creates a user account for him/her-self first and uses the user account to browse the courseware.

Considering that each institution may have a different teaching schedule, imaging modalities in MITS/DATS system are “independent” each other. Our teaching/learning sequence is as follows: X-ray, CT, MRI, NMI (PET), and Ultrasound. Administrator/instructor can open the imaging modalities one by one based on teaching/learning schedule (this is our hybrid teaching practice) or open all imaging modalities at the same time.

As administrator/instructor, one should browse through all pages to have a general idea of how the system is composed before assign it to students.

When a user enters any imaging modality, he/she will pass through following learning steps

- Modality pre-test (about 5 questions) to exam user’s pre-knowledge
 - Module 1 pre-quiz (1~2 questions) to exam user’s background for the module
 - Contents of Module 1
 - Module 1 post-quiz (1~2 questions) to exam user’s understanding for the module

 - Module 2 pre-quiz (1~2 questions) to exam user’s background for the module
 - Contents of Module 2
 - Module 2 post-quiz (1~2 questions) to exam user’s understanding for the module
 - ...
 - Module n pre-quiz (1~2 questions) to exam user’s background for the module
 - Contents of Module n
 - Module n post-quiz (1~2 questions) to exam user’s understanding for the module
- Modality post-test (the number of questions is set by Administrator/instructor in Module Management)
- Modality pre-test
-
- Modality post-test

Within each imaging modality, a user (student) must go through the steps sequentially (we consider the modules are logically designed in such sequences. We understand that different institutions may have different methods to deliver the contents for the teaching modules. We just follow the commonly used approach.

After the user finishes all modalities, he/she can go to the Final Review section where a combined review test is given. The number of final review questions is controlled by administrator/instructor (under Modality Management)

All pre/post quizzes within a module, pre/post tests within a modality and final review test appear one time only. After a user submits the post-quiz question, the module becomes “open” to the user (he/she can access the module any time later).

As introduced in the beginning, the contents of each module include

- 1) text description
- 2) figure/picture/image illustration
- 3) interactive animation
- 4) interactive simulation
- 5) pre-post assessment
- 6) library of medical imaging application (under construction)

1) and 2) can be used as class handouts. Interactive animation is the “cartoon” type presentation, mainly used to describe physics or chemistry/biology principles. Interactive simulation is the “real” engineering process behind the screen for image reconstruction or other processing. 5) can be used to assess students’ performance or used as test practice. 6) can be used as demonstration examples (this function is under construction).

The MITS/DATS system is updated on a semester basis. Three institutions are developing this system together. In terms of imaging modalities,

Florida Atlantic University (FAU) works on Ultrasound imaging modality

Florida International University (FIU) works on NMI (PET) imaging modality

University of Miami (UM) works on X-ray, CT and MRI imaging modalities

The updates include text/figure revision, animation revision and addition, simulation revision and addition. We plan to develop 40 to 50 animation simulations (10 animations have been embedded, Aug. 2011) and 5 to 10 simulations (2 simulations have been embedded, Aug. 2011) to the system. The progress and other announcement will be announced at the MITS/DATS homepage.

We very much appreciate your feedback on any issue related to the system. Our goal is to create an efficient hybrid teaching/learning environment to deliver medical imaging education to students.