DISTANCE LEARNING

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Agenda

- Distance learning
  - Background
  - Advantages/disadvantages
  - Key aspects of success
- Online learning for CE and BMET
  - CE and HTM resources
  - BMET online degree and certificate programs
  - University of Vermont/Pontificia Catolica courses
    - Need, development, review, and evaluation
  - Hospital orientation and training courses
  - Non-technical training
- Videoconferencing
  - Classroom, conferences, and meeting use

What is Distance Learning?

- Teacher &/or materials at one location→ Students at another
- For the purpose of this discussion
  - "Cyber" or network training
    - Internet
    - Intranet
  - Video conferencing
    - TCP/IP
    - ISDN, Satellite, etc.
  - Combined classroom/Distance learning
    - E.g. videoconference into live class, web based training supplemental to live class

Why Online Learning?

- Asynchronous – 24x7
  - Online educational resources always available
  - Do not interfere with work or other activities
- Cyberspace – no limitation on location
  - Just need a computer and connection
  - No travel time, hard scheduling
  - No fuel costs, tolls, parking,

Why Online Learning?

- Can be more personal for some students
  - Students who are uncomfortable asking questions & contributing to discussion
- More learning styles can be accommodated
- Students have to become more responsible for their learning

Why NOT Online Learning?

- No computer or computer old
- No connection to Internet or poor connection
- Don't understand computers
- I don't like to write or read
  - Verbal only
- Have to be with people to learn in classroom setting

What is important for students in Online Learning?

- Regular access
- Regular interaction with other students and instructor
- Independent actions – responsibility
- Basic computer skills
- Interest to go beyond basics
  - Links, exercises, searches
- Practice "cyber-knowledge" in the real world

What is important for instructors in Online Learning?

- Engagement and community
- Clear instructions
- High standards
- Communication, communication…
- Independent actions – responsibility
- Threaded discussions
- Clear evaluations
  - Time, assessments, participation
- Creatively use the web's resources

Features of online courses

- Computer-based simulations
  - Flash
  - Labview
- Videos
  - Professional
    - Even YouTube
- Case studies
- Scenarios

Online courses for Clinical Engineering/HTM

- David & Judd
  - http://www.tmc.edu/cth/mtm-01/
- British Colombia Inst. Of Tech
  - http://www.bcit.ca/study/courses/bmet7101
- Segalewitz
  - https://www.courses.psu.edu/be_t/be_t297_sis1/index.html

Online programs for Biomedical Equipment Tech

- Barbara Christie, IUPUI
  - http://www.engr.iupui.edu/bmet/courses.shtml?menu=courses
- DeVry University
  - http://www.devry.edu/programs/biomedical_engineering_technology/about.jsp?WT.ac=bmet
- AIMS – Military
  - http://www.aimsced.com/Distance/biomed.htm
- Texas State
  - http://www.marshall.tstc.edu/areas/biomed.shtm

Ditec and RSTI?

Certificate or degree programs

Supplemental Online Courses: Personal Development

- Customer Service Training:
  - http://www.LearnCustomerServiceOnline.com
- **Self-paced Courses**
  - Harvard Manage Mentor: Managing Workplace Stress
  - Harvard Manage Mentor: Managing Your Time
  - Harvard Manage Mentor: Managing Your Time (For use with Screen Readers)
  - Harvard Manage Mentor: Setting Goals
  - Harvard Manage Mentor: Focusing on Your Customer
  - Harvard Manage Mentor: Marketing Essentials

Supplemental Online Courses: Software

- Microsoft E-Learning
  - http://business.microsoftelearning.com/
- Element K
  - http://knowledge.elementk.com

University of Vermont Clinical Engineering

- Program started in 1973
- University department aligned with biomedical engineering
- Staff of 50 engineers & technicians
- Contracts with 28 hospitals in Vermont, New Hampshire and New York
- Also services university equipment, and designs and fabricates research instrumentation

Univ. of Vermont Orientation and Mentoring program

Daily Training Agenda

- *Review Clinical Device*
  - Education on Performance Inspection & Common Repair Scenarios 1 hour
- *Self Study Hands On*
  - Time to master the testing parameters of the device and documentation 3 hours
- *Biomedical Technician Duties*
  - Time with the mentor performing / learning healthcare facility operations 3 hours
- *Evaluation*
  - End of the day review of Clinical Device, Testing & Questions .5 hours

Univ. of Vermont Orientation and Mentoring program

Online courses

- Medical Equipment Technology courses
  - Basic and advanced
  - Technology management
- Customer Service Training
- Microsoft E-Learning
- Certification by mentor and supervisor

Online Course Project Background

- Latin America and the Caribbean countries are rapidly expanding their healthcare technology usage.
- The effects of the new technologies have benefited patients, but problems have occurred due to a lack of management, training, guidelines, and local technical support especially in developing countries.

Online Course Project Background

- **Limited medical device regulations,**
- **A high percentage of devices that are out of service,**
- **Weak after sale device support with nearly all service from manufacturers or their representatives,**
- **A shortage of technical staff in hospitals,**
- **Very limited maintenance budget, and**
- **Limited technology management.**

Pan American Health and Education Foundation Grant

- Grant submitted to Pan American Health and Education Foundation in December 2005 to develop a bilingual on-line course in Medical Equipment Technology and Clinical Engineering
- Funded June 2006-July 2008
  - *Course in English completed and taught in year one*
  - *Course in Spanish completed and taught in year two*

This project was funded by the PAHEF from a fund created through the generosity of the people of Taiwan

PAHEF Grant

A collaborative effort

- *Universidad Católica – PUCP (Peru)*
- *Universidad – CES (Colombia)*
- *University of Vermont - UVM (USA)*

Components of a successful training course

- Accessible
  - ***24x7 available for study***
- Cover key aspects of the technology
  - ***Principles, operation, and maintenance***
- Comprehensive coverage of many common technologies
- Include management principles
- Collaboration between universities in the Americas
- Value established at a high level
  - ***Time and resources allotted for students who will be primarily hospital technical staff (HTS)***

On-line training course: *Principles*

- ***Provide a basic understanding of medical equipment technology, and its management and safety,***
- ***Help the hospital technical staff better communicate with physicians, nurses, other clinicians, administrators, and equipment vendors.***
- ***Provide an understanding of issues related to good design, patient safety, effective application, and common service problems, and***
- ***Develop interest, promote better interaction with clinical engineering peers, and as preparation for further study and more advanced application of the principles***

Potential Students

- Course designed for
  1. Primary: Technical staff in hospitals – electricians, maintenance and other technical personnel
  2. Engineers without training in medical equipment, life sciences, healthcare, and other areas
  3. Nursing and other clinicians

On-line training course Level 1

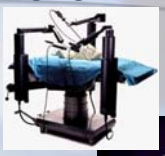
- **Introduction**
  - Healthcare Technology Management/Clinical Engineering
- **Patient safety**
  - Electrical and other physical hazards
  - Equipment failure modes
  - Common equipment application issues
  - Environmental concerns
- **Troubleshooting principles**
- **Basic principles**
  - Overview of the human body
  - Medical terminology
  - Electrical, mechanical, optical and computer concepts
  - Transducer, medical instrumentation and systems concepts

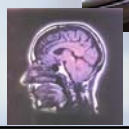
On-line training course Level 1

- Measurement and diagnostic instruments
  - Electrocardiography
  - Cardio-respiratory
  - Fetal and neonatal monitoring
- Therapy devices
  - Defibrillators
  - External Pacemakers
  - Infusion and medication technology

On-line training course Level 2

- **Therapy devices**
  - Ventilators
  - Surgical devices
  - Physical therapy
  - Radiation therapy
- **Imaging systems**
  - Radiography
  - Fluoroscopy
  - Computed tomography
  - Nuclear medicine
  - MRI
  - Ultrasound
- **Clinical laboratory**





On-line training course Level 2

- **Medical information technology**
  - Clinical information systems
  - PACS/imaging networks
  - Telemedicine/teleradiology
- **Patient safety**
  - Device related incident investigations
  - Standards, regulations and best practices
- **Technology Management/Clinical Engineering**
  - Healthcare technology management policy
  - Healthcare technology management principles
  - Clinical engineering activities and services
  - Clinical Engineering department operations
  - Clinical engineering professional activities

Lab tests

Diagnostic Images

On-line training course

Areas covered for each device/topic area:

- *Principles of operation*
- *Proper clinical application*
- *Device safety*
- *Common problems and solutions*
- *Inspection, testing and preventative maintenance*
- *Technology management*

On-line training courses

- Basic Course - Patient Care Equipment
- Advanced Course – High Tech Systems and Technology Management
  - http://its.uvm.edu/medtech/index.htm l
  - https://uvm.blackboard.com/webapps/portal/frameset.jsp
  - https://uvm.blackboard.com/webapps/portal/frameset.jsp

English Online course University of Vermont

- **Nursing & Health Sciences**
  - **Patient Care Equipment and Technology**
    - *May 19 thru June 21*
  - **Advanced Medical Equipment Systems: Technology, Patient Safety & Management**
    - *June 22 thru July 31*

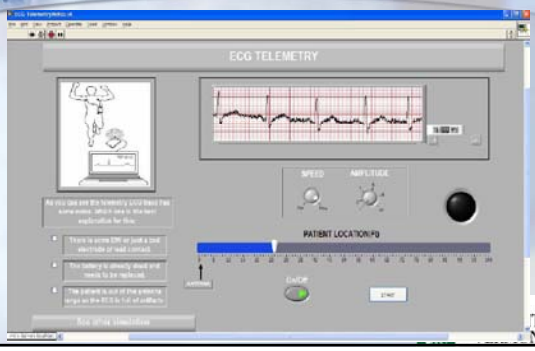
On-line Course System

- ***Blackboard*** is an integrated toolset for the development and delivery of courses and course materials on the web. ***Blackboard*** provides tools, e.g., discussion boards, live chats, quizzes, and exams. It can also be used to distribute content such as syllabi, lecture notes, grades, and other resources.
- http://bb.uvm.edu

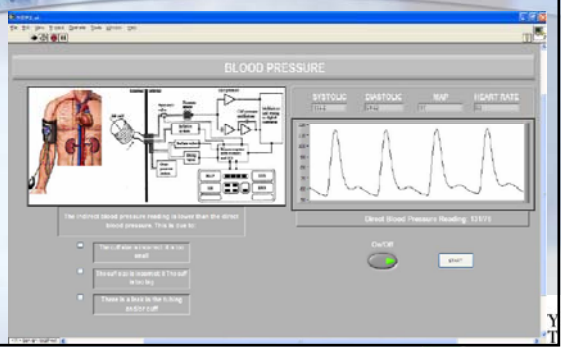
Use of Medical Equipment Interactive Simulations: *Operation and Problem Resolution*

- Simulations created in National Instruments Labview
- Labview produces HTML output
- Server version delivers simulations
- Example:
  - Electrocardiographic lead problem
  - Pulse oximeter failure
  - Non-invasive blood pressure inaccuracy
- Simulations developed by clinical engineering interns from Colombia and Peru

Simulation – ECG Telemetry



Simulation – Blood pressure



Videoconferencing Examples

- International videoconferences
  - PUCP in Lima, Peru
    - Internet II connection
    - Polycom system

Videoconferencing Examples

University of Vermont (UVM): Clinical Engineering Internship Program

- Five month paid internships
  - One month formal training
  - Four months of clinical engineering assistance to our CE's and project work
    - Database analysis
    - Device development
    - Simulations
    - Online course development
- **UVM, PUCP Lima and CES Medellin Collaboration**

University of Vermont (UVM): Clinical Engineering Internship Program

Goal: Provide clinical engineering and technology management fundamentals, experiences and project work.

Focus areas

- Clinical engineering overview
- Clinical instrumentation
- Technology Planning
  - Overview
  - System and protocol
  - ECRI Institute
  - Purchase consult assistance

Clinical Engineering Internship Program

- Technology Management
  - Maintenance concepts and issues
    - Medical device service
    - Optimizing PM
    - Capital asset protection partnership
  - Patient safety
    - Overview
    - Incident investigations
    - SMDA and MEDSUN
    - Environment of Care and Hospital Safety
    - EOC and JCAHO overview
    - Hospital safety programs
  - Standards and regulations
  - Risk management programs
  - Computerized Medical Equipment Management Systems
    - HEMS
    - Data analysis and reporting
    - IT systems in healthcare

Clinical Engineering Internship Program

- Clinical engineering assistance to facilities
  - Facilities overview
  - CE assistance to facilities
  - EMI and electrical power issues
- Clinical engineering department management
  - Overview
  - Healthcare system
  - Baldridge Criteria
  - Quality indicators and productivity
  - Financial
  - Human resource management
  - Training
- Clinical engineering professional activities
- Cardiac surgery services

Clinical Engineering Interns

SCHEDULE

- Maria Arbelaez, EIA Colombia January 2005 – June 2005
- Tatiana Molina, EIA Colombia January 2007 – June 2007
- Santiago Montes, EIA Colombia – September 2007 December 2007
- Alejandro Posada, EIA Colombia – January 2008 – May 2008

Tatiana Molina shown developing simulations for patient care course

Clinical Engineering Interns

SCHEDULE

- Luis Jiménez, PUCP Peru – July 2007 – December 2007
- Roger Ayala, PUCP Peru – July 2007 – December 2007

Collaborations

UVM nursing

CES biomedical engineering

PUCP engineering

Pan American Health Organization

- ***Leader in Healthcare Technology Management in the Caribbean and Latin America***

Antonio Hernandez, Director Technology and Health Facilities, PAHO, Washington, DC

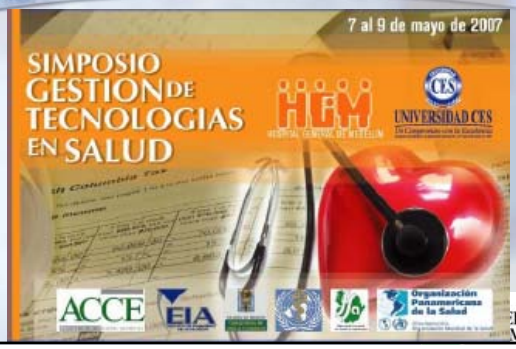
Pan American Health Organization

- ***A large portion of the nearly 50 HTM symposiums and advanced clinical engineering workshops have been sponsored by PAHO***
- ***Health ministry level conferences***
  - ***Symposium for administration***
  - ***Workshop for engineers***
- ***Focus***
  - ***University – Healthcare Collaboration***
    - ***Health ministry, social security, governmental***
  - ***Training programs to support capacity building***

Pan American Health Organization

- PAHO Advanced Clinical Engineering/Healthcare Technology Management workshops
  - *Medellin: May 7-11*
  - *Lima: August 13-17*
- Leverage the success of the PAHO workshops to call for the development of technical staff in front line support of healthcare technology

Healthcare Technology Management Symposium and Workshop Medellin, Colombia – May 2007



Healthcare Technology Management Symposium and Workshop Lima, Peru – August 2007

Opportunities for HTM Development In Peru

Deputy Health Minister, Edward Sanchez, MD

Congressional hearing 3/07 – Tobey Clark, Rigoberto Centeno, PAHO - Lima and Luis Vilcahuamán

Additional Opportunities

- Develop vendor sponsored demonstrations and training sessions to supplement the online course
  - Live demonstrations and technical training from vendors should follow the online course or course module
  - Latin America – 3rd or 4th quarter 2008

Hands-on Training

PATH TO SUCCESS

PAHO WORKSHOPS>

ONLINE COURSE>

LIVE TRAINING =

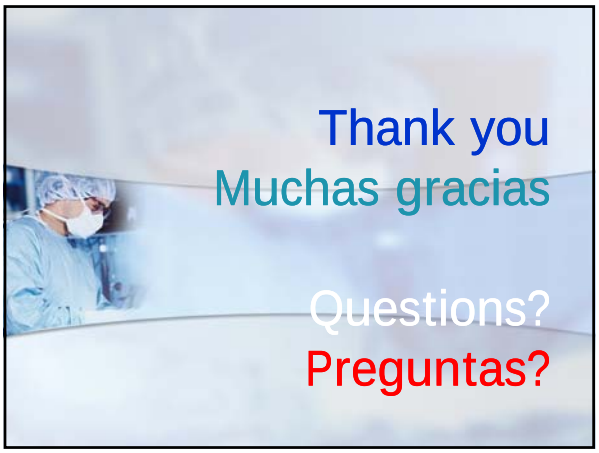
HEALTHCARE BENEFIT

Course Challenges

- Telecommunications infrastructure
  - Availability of high speed lines
  - Computer availability
- Showing the value of the course
  - Awareness
  - Value to healthcare improvement in the country
  - Value to administration, authorities and supervisors
    - **Finding and developing champions**
  - Value to participants
  - Allowing staff time to take the course
  - Resource commitment
- Collaboration with universities in other Caribbean and Latin American countries
- General logistical issues
  - Long distance communication
  - Software, language, etc.

Future

- Finalize course content and delivery
- Versions focused on
  - Technical staff
  - Non-biomedical engineers
  - Nursing
- Portuguese translation for Brazil
  - French translation for Francophone countries
- Course offerings from other universities
  - Latin America and the Carribean
- Additional courses, hands-on training supplements, workshops, etc.


Thank you
Muchas gracias
Questions?
Preguntas?