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
  - I 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_t297sis1/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.devr.edu/programs/biomedical_engineering_technology/about.jsp?WT.ac=bmet
- AJMS – 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:
- 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
- Element K
  - [http://knowledge.elementk.com](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

University 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.
  - 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.*

**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.

**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).

**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.

- **Introduction**
- **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.

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**University Católica – PUCP (Peru)**

**Universidad – CES (Colombia)**

**University of Vermont - UVM (USA)**
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/teleurology
- 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

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 course
- Basic Course - Patient Care Equipment
- Advanced Course – High Tech Systems and Technology Management
  - http://its.uvm.edu/medtech/index.htm
  - 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

- Interactive videoconferences
- PUCP in Lima, Peru
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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

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
  - HEMIS
  - Data analysis and reporting
  - IT systems in healthcare

Clinical Engineering Interns

SCHEDULE
- Maria Arbelaez, EIA Colombia – January 2005 – June 2005

Clinical Engineering Interns

SCHEDULE
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

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

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

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
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
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 Caribbean
- Additional courses, hands-on training supplements, workshops, etc.
Thank you
Muchas gracias

Questions?
Preguntas?