Biomedical Technology Online Courses for the Americas

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Why Online Learning?

- Asynchronous – 24x7 access
  - Online educational resources always available
  - Does not interfere with work or other activities
- Cyberspace – no limitation on location
  - Just need a computer and connection
  - No travel time
  - No set scheduling
  - No travel costs – gas, parking, tolls, tickets
Key attribute of online courses:

Full Use of the World Wide Web Resources!

- Documents
  - *E.g. WHO Medical Device site*
- Tutorials
- Case studies
- Scenarios
- Videos
  - *Academic, YouTube, Industry*
- Computer-based simulations

From the EMS Professional website
Need for Training in Developing Countries

- 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 with few trained in medical technology support,
- Very limited maintenance budget, and
- Limited technology management
Project Funding

- Grant submitted to PAHO Foundation* in December 2005 to develop a bilingual online course in Medical Equipment Technology and Clinical Engineering

- Original Funding June 2006-July 2008
  - Course in English completed and taught in year one
  - Course in Spanish completed and taught in year two

- More recent funding
  - WHO & PAHO 2009 (Eastern Caribbean students)
  - PAHO Foundation 2011-2012 (UTN Mendoza)
  - PAHO 2015 (HT Planning & Management course)

* PAHO Foundation (formerly called the Pan American Health & Education Foundation), Washington, DC, USA www.pahofoundation.org
Course Audience

- Designed for
  1. **Primary**: Technical staff in hospitals – BMET, electricians, maintenance and other technical personnel
  2. Engineers without training in medical equipment, life sciences, healthcare, and other areas – career changers
  3. Nursing and other clinicians
  4. Administrators and managers
On-line training courses

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
Initial Course Evaluations

Vermont 2007-2008
• **Students:** 80% engineering, 10% nursing, 10% miscellaneous
• **Approval rating:** 100%

Colombia 2008
• **Students:** 56% engineering; 44% miscellaneous
• **Approval Rating:** 85%

Peru 2008
• **Students:** 100% professionals - engineering, nursing, and technicians
• **Approval rating:** 100%
Biomedical Equipment Technology Sequence*

Three online courses plus one laboratory course

- **Patient Care Equipment**
  - Anatomy/physiology, engineering principles, common bedside equipment

- **Advanced Medical Equipment Systems**
  - Imaging, surgical systems, therapy, laboratory, clinical information systems

- **Medical Equipment Application**
  - One week hands-on laboratory course/internship in hospital

- **Healthcare Technology Planning & Management**
  - Convergence of technology, health technology life cycle, clinical engineering, global HTM

* 2015 University of Vermont course sequence

** Original PAHO Foundation funded courses
The PAHO Virtual Campus for Public Health offers over 100 courses with adult learners from 140+ institutions enrolled from the Americas.

“The Virtual Campus of Public Health is a network of people, institutions and organizations that share courses, resources, services and activities of education, information and knowledge management in training, with the common purpose of improving the skills of the workforce and practices of public health through the development and innovative use of information and communication technologies for continuous improvement in the performance of continuing education programs in health.”

September 2014, the original PAHO foundation funded biomedical technology online courses were placed on the PAHO Virtual Campus for Public Health.

- Reaches adult learners in the healthcare system in the Americas who do not have funding for university courses.
PAHO Virtual Campus for Public Health

**Introduction to Biomedical Technology 100% online course**

- Patient Care and Advanced Technology courses combined into one seven (7) month course
- Healthcare environment; review of the human body and technical principles; intensive care equipment, imaging, surgical, laboratory, therapy, and clinical information systems
- 52 participants chosen through a very careful selection process

<table>
<thead>
<tr>
<th><strong>MAIN TOPICS</strong></th>
<th><strong>Spanish version:</strong></th>
<th><strong>English version:</strong></th>
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<tbody>
<tr>
<td>- Device principles</td>
<td>-252 applications</td>
<td>-47 applications</td>
</tr>
<tr>
<td>- Proper clinical application</td>
<td>-34 selected</td>
<td>-19 selected</td>
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<tr>
<td>- Patient safety</td>
<td>-Participants from 20 countries:</td>
<td>-Participants from 9 countries:</td>
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<td>Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Dominican Republic, Uruguay and Venezuela.</td>
<td>Anguilla, Antigua y Barbuda, Barbados, Bahamas, Belize, Dominica, Guyana, Saint Vincent &amp; the Grenadines and Trinidad &amp; Tobago.</td>
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Example assignments:
- Quizzes

Both the slowly changing cuff pressure and rapid, smaller amplitude pressure oscillations are measured to determine blood pressure readings with the Non-invasive blood pressure monitor.

Select one:
- True
- False

The QRS portion of the ECG has a magnitude of 1 millivolt (mV) on Lead II and a magnitude of 0.5 mV on on Lead III. What is the QRS magnitude on Lead I?

Select one:
- A. 0.5 mV
- B. 1.0 mV
- C. 1.5 mV
- D. 5.0 mV

Match the infusion alarm with the hazard that it prevents:

- Bag empty: Choose...
- Occlusion: Choose...
- Air in line: Choose...
- Door open: Choose...
  - Free flow
  - Embolism
  - Infusion into body space outside the vein
  - Potential clotting due to lack of fluid flow
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• Course completion
  – **English**: Twelve passed; six with excellence and five with distinction
  – **Spanish**: Fifteen passed; two with excellence and six with distinction

• Course Evaluation
  – Positives (strongly agree)
    • The instructor is knowledgeable about the subject: 100%
    • The course content is valuable: 82%
    • The course assignments contributed to my learning: 82%
  – Areas for improvement (strongly agree)
    • Understanding the grading criteria for assignments: 37%
    • Instructors contribution to online discussions: 46%
  – No negative ratings for any evaluation question

• Example student comment
  – “Thank you, it was a wonderful introduction for a first time to biomedical engineering and hospitals; well laid out; Good assignments and relevant discussions”
Results 2007 - 2015

– Over 1000 students from 40 countries have taken course
  – Colombia, Peru, Mexico, Venezuela, Uruguay, Costa Rica, Bolivia, Brazil, Uruguay, Paraguay, Chile, Argentina, Puerto Rico, Dominican Republic, Barbados, Jamaica, Grenada, Antigua, St. Lucia, Belize, British Virgin Islands, St. Vincent, St. Kitts, Turks & Caicos, France, Spain, China, Trinidad and Tobago, Dominica, Barbuda, Guyana, Bahamas, Anguilla, Honduras, Cuba, El Salvador, Panamá, Ecuador, Nicaragua, and the USA

– English & Spanish versions taught at:
  • PAHO Virtual Campus for Public Health
  • Universidad CES in Medellin, Colombia
  • Pontificia Universidad Catolica de Peru in Lima, Peru
  • Universidad Technological Nacional/Mendoza, Argentina
  • University of Vermont in Vermont, USA
Course Challenges

• Technology 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
  – Allowing staff time to take the course
  – Resource commitment

• Continual updates
  – As technology changes
  – Dead link replacement
Future Directions

- Additional courses on PAHO Virtual Campus for Public Health
  - English & Spanish Healthcare Technology Planning and Management course to be offered in July
    - Convergence of technology, health technology life cycle, clinical engineering, global HTM
- Portuguese translation
  - Adaptation for Brazil
- Combine online with hands-on workshops at regional sites
Thank You

Mahalo

Kiitos

Toda

Grazie

Obrigado

Takk

Gracias

Merci