PACS as a Learning Tool

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Objectives

• To define active learning
• To describe the use of PACS as a learning tool in a university setting
• To develop interactive image tutorials using PACS

Outline

• The QUT Context
• PACS defined
• Active Learning defined
• Feature of PACS
   – Examples of application to learning environment
• Student Feedback
• Conclusion
• References

Location

Queensland University of Technology (QUT) is located in Brisbane where it has 3 campuses

Medical Imaging learning context

• University program is conducted on-campus and there is no university hospital
• Pre clinical skills are developed in a laboratory situation using simulation and role play
• Students are placed in clinical departments for blocks of 4-6 weeks per semester

QUT has a global outlook, some 42,000 students, including 6000 from overseas, and 4000 staff. It has an annual budget of more than $780 million, with an applied emphasis in courses and research.
On-campus equipment

- General x-ray equipment with multiple vendor CR systems plus a DR unit and ultrasound machine all of which can send to PACS
- Dedicated computer lab where students access PACS

Active Learning

- From Constructivist Theory
- Can be defined as:
  - “Opportunities for students to make sense of the subject matter - Knowledge is actively constructed by the learner, not passively received from the environment” Macmillan 2005 p 96
  - “Teaching is not a matter of transmitting but of engaging students in active learning, building their knowledge in terms of what they already understand” Biggs 2009 p 21

Factors to consider

- Connection - contextual environment
  - “Authentic learning environments should provide an authentic context that reflects the way knowledge will be used in real life” Herrington 2006 p 4
- Relevance
  - “Students are most motivated and learn best when they are immersed in an environment that causes them to realize why they should learn” Guilford 2005 p 138

PACS

- Picture archival and communication system
- Components
  - Image acquisition system
  - Image display system
  - Network system
  - Storage system

PACS at QUT

- General X-Ray
- Fluoroscopy
- CT
- US
- MRI
- NM
- Other

Picture Archival and Communication System

Multiple User Access

Multiple Concurrent Student Access
PACS Features utilised at QUT

- Access to images acquired in laboratory
  - Student access to practical tasks
- Access to image folders of sample images
  - Student access to multiple clinical examples of practical tasks
- Access to PACS image manipulation tools
  - Student engagement with image processing
- Access to stored images
  - Student access to reference images including examples of pathology

Access to PACS

- Cloud based system
- Dedicated On Campus Laboratory
- Scheduled tutorial sessions
  - Peer interaction
  - Group discussion
- Some off campus connectivity

Access to images acquired in laboratory

- Students image anthropomorphic phantoms in the laboratory setting
- PACS access to student images

Access to image folders of sample images

- Access to images of clinical examples of the practical task
- Demonstrate the positioning in a range of patient presentations/scenarios

Access to PACS image manipulation tools

- Image Manipulation
  - Window level
  - Density measurement
  - ROI measurements
  - Multi-planar reconstruction

Window Level

- Students can interactively change the window width and level and observe the changes in the image
Density Measurement

- Use of Density measurement facility to demonstrate principles eg scatter

Multi-Planar Reconstruction

- Students can interactively create MPR’s
  - Allows interactive review of anatomical structures
  - Allows understanding of the three dimensional nature of CT imaging

Access to stored images

- Access to image files of library cases demonstrating
  - Technically good examples
  - Technically difficult cases
  - Normal anatomy
  - Common pathological appearances
  - Historical perspectives

Advanced Image Processing

- Dedicated advanced processing workstation
- Student engagement with 3D data sets
  - Examples of 3D techniques
    - Shaded surface display
    - Volume rendering
    - Maximum Intensity projection

Student Feedback

- This has been a really valuable experience. It was helpful to put things learnt in lectures into practice. Student Feedback 2012
- I think this practical approach has been very beneficial and feel I will be able to better retain this content now than if it was just presented theoretically. Student Feedback 2013
- The tutorials aided my understanding of the unit and will help me in my next placement. They tied together the theory from previous units with the practical skills we will need in the future. Student Feedback 2013
- Nice to put the theory into practice in a hands-on way. Having the small tasks to complete gave me direction in my learning. Student Feedback 2013

Use of Interactive Tools in the PACS environment has enhanced my understanding of CT

Student Feedback Chart
Conclusion

• The use of the PACS environment has extended our ability to provide authentic learning tasks
• We are still exploring further ways to enhance the learning experience using the PACS environment

References