The Use of Educational Technology in an Engineering School: Then, Now, and the Future

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1. INTRODUCTION TO UNSW
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Fast Facts

✓ Number of students - > 52,582 (14,607 international)

✓ Number of staff – 7,737

✓ 8 Faculties, 1 College, 65 Schools, 97 affiliated institutes and centres

✓ Engineering – 9 Schools

✓ Electrical Engineering & Telecommunications
  ✓ Students – approx. 1,000 (700 UG, 200 PG Coursework, 100 PhD)
2. Why Educational Technology

✓ Common challenges in teaching/learning
  ✓ Maintaining students’ attention
  ✓ Communicating difficult mathematical concepts
  ✓ Students learn at differing pace
  ✓ Lack of fluency in written/spoken English
  ✓ Students are busier! - 45% in part-time work 2003-2006
  ✓ 36% of students study less than 5 hrs/wk outside schedule classes.

► Smaller percentage of students are/were grasping key concepts in live lectures

► Students left to develop the critical understanding in their own time … can lead to a vicious cycle!

► An alternative delivery mode which would encourage and support self-directed study.
2. Why Educational Technology in this School

✓ Statistics from 2003-2008:
  ✓ 75% of students study less than 10 hrs/wk outside schedule classes.
  ✓ 36% of students study less than 5 hrs/wk outside schedule classes.

✓ Traditional lecture deliver modes (including PowerPoint presentations) were not as effective as required.
  ➔ An alternative delivery mode which would encourage and support self-directed study.
3. The Virtual Classroom

- The School of EE&T developed a virtual classroom and DVD-based lecture facility in 2005.
- Virtual Classroom Facility – allows for capture of lecture/tutorial material
  - Synchronised electronic whiteboard content
  - + lecturers handwriting annotations
  - + audio and video of lecturer
3. The Virtual Classroom

✓ Flexibility
  ✓ Students can of course watch at a time of their choosing.
    ✓ Although they are not meant as a replacement to face-to-face lectures, but an additional support resource.
  ✓ Recording with students (live) or without.
  ✓ Lecturer can record smaller 10-15 electronic whiteboard-based clips, giving more detailed explanations for difficult concepts, otherwise not practical in a traditional face-to-face lecture.
  ✓ Annotated solutions to selected difficult (and simple) tutorial questions.
3. The Virtual Classroom

✓ Increased application
  ✓ Many lectures have been recorded in this way and distributed to students.

✓ Now used in Summer semester courses (November-February)
  ✓ Run in blended and block-mode format
  ✓ Without face-to-face lectures but with experienced mentor support and interaction.
4. Distributed Teaching Laboratory

✓ Electrical Engineering degree program is traditionally laboratory-intensive – even more so since program review/revision of 2005/6.
  ✓ Weekly or fortnightly labs of 2/3 hours duration.
  ✓ Resource implications?

✓ Distributed Laboratory Facility – developed in 2010, enabling laboratory classrooms to be “connected”.
  ✓ Similar technology to that implemented in the virtual classroom (electronic whiteboard, cameras and video recording facilities).
4. Distributed Teaching Laboratory

- Demonstration in one room streamed into another (recordable)
- Two-way interactive via electronic whiteboard.
- Zooming in on hardware to show practical concepts.
- Significant efficiency/consistency in teaching.
- Used increasingly, particularly in final year design course.
5. What does the future hold?

✓ Sustained utilisation/application of the existing technology
  ✓ Virtual classroom and distributed teaching lab
  ✓ Summer semester courses

✓ iPad/Tablet PC use (in use currently)
  ✓ Content delivery
  ✓ Discipline specific
  ✓ Support

✓ Cross-institutional collaboration + MOOCs (work in progress)
5. iPads/Tablet PCs

Explain Everything (iPad)

- Feature rich presentation app

- Dynamic annotation, page insertion, audio and slide recording

- The “mobile virtual classroom” facility!

2. VOLTAGE

- Thus to fully describe a voltage across an element, we require assigning:
  - a “+ terminal” and a “- terminal”, as well as a value (or variable name)
  - A value (or variable name) – this denotes the voltage at the “+ terminal” with respect to the “- terminal”

- Example: if \( V_{ab} = 7 \text{V} \), then we say terminal \( a \) is 7V positive with respect to terminal \( b \). Or the voltage drop from \( a \) to \( b \) is 7V.

- \( V_{ba} = ? \quad V_b - V_a = - V_{ab} = -7 \text{V} \)
5. iPads/Tablet PCs

AirServer

✓ Allows the iPad (multiple) to mirror its screen to a PC/Mac on the same wireless network. This facilitates:
  ✓ mobile presentation - good also for small classes/group work where students can interact via their own device or the teacher’s.
  ✓ recording of iPad work sessions on a PC/Mac
5. iPads/Tablet PCs

**iCircuit**

- Powerful discipline specific app for circuit analysis
  - Can build and simulate circuits quickly
- Great for demonstration of theoretical concepts in lectures, checking solutions to solving tutorial problems.
5. Works in progress - Collaboration + MOOCs

✓ Cross-institutional collaboration
  ✓ Delivery of engineering material between UNSW and Taylor’s University College using educational technology.

✓ MOOCs
  ✓ Currently developing a MOOC on electrical circuits, aimed at entry level engineering students + senior High School students.
  ✓ Its purpose:
    ✓ Remediation for existing students.
    ✓ Marketing plus possible extra admissions criteria.
    ✓ Exploration of how to improve delivery of online material with a hardware lab component and with the use of new/emerging technology such as iPads/Tablets.
6. Conclusion

✓ Educational technology within the School Electrical Engineering and Telecommunications at UNSW has slowly evolved over the past decade and has served as a valuable resource for supporting student learning.

✓ This finds us at an exciting time, where we can look to new and emerging technologies, and when the education landscape is shifting.