A Blended Learning Case Study – First Year Engineering Degree Module

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The Royal Academy of Engineering VP’s Workshop: Experience-Led Degrees;
September 9th, 2008
Background

**Blended Learning:** “Harnessing technology to enhance Learning, Teaching and Assessment”.

**Case Study:**
- Fluid Mechanics and Thermodynamics
- Core module (15 credit point / single semester)
- Part of MEng/BEng Aerospace, Aerospace Systems, Automotive and Mechanical Engineering degree programmes
Baseline (prior to 2002)

i. Lectures (didactic 1:~150)
   • instruction, motivation and sign-posting / making links

ii. Tutorials (interactive 1:~25)
   • student participation working on tutorial sheets and supporting 2 laboratory exercises.

iii. Laboratory studies x 2 (interactive 1:~25)
   • Practical application of theory - from (i), “Hands on” activities
   • Some social-constructivism

• Assessment based on:
  • 70% final examination (at week 12)
  • 20% laboratory reports (conventional - teacher marked)
  • 10% phase test (set at week 7/8 - teacher marked)
Drivers for change

• High examination failure rate

• Increasing student numbers
  – Increasing difficulty in providing personal feedback
  – Increasing difficulty to track student’s progress

• Increasing range of abilities (qualified to similar levels!)
  – Previous assumptions on student’s capabilities becoming invalid

• Increasing range of motivation (or lack of motivation)
  – Less time-on-task
Good practice…

✓ time-on-task
✓ prompt feedback
✓ uses active learning techniques
✓ high expectations
✓ respects diversity of learners
✓ encourages co-operation amongst students
✓ encourages contact between student and staff

✓ Learning is a conversation
✓ Learning is not a spectator sport
✓ The learners have much to offer as well as gain
What did we change? - a chronology of developments

2001 StudyNet – opportunities to provide:
  – Improved teaching materials – on-line access
  – Additional support material
  – Encourage student participation via discussion forums

2002 Weekly Assessed Tutorial Sheets (WATS)
  – To encourage student engagement

2004 Peer assessment of laboratory reports
  – Learning through assessing
  – Sharing good and bad practice

2005 Just-in-time teaching
  – Intelligence led teaching

2006 IWB to encourage collaborative learning

2007 On-line tutorial using Elluminate
Welcome to the course website for Fluid Mechanics & Thermodynamics.

As a teaching team we will endeavour to support your studies both in class and also on-line via StudyNet.

We will try many things and look to you to engage with all the on-line activities. We will use these activities to help you learn and also to help you explore the subject.
The Use Of Discussions Within StudyNet — encouraging cooperation

Objectives:

• provide additional information, promoting specific activities
• provide tutor prompts
• support tutorial questions – 48 hour response time
• encourage student feedback
• support assessments
Teaching Resources

[Edit page introduction]

- Hidden Documents (HIDDEN FROM STUDENTS)
- Thermodynamics Lectures
  - Slides shown in lectures
- Worked Examples
- Thermodynamics Lecture Notes
  - A cut down version of the lecture slides
- Thermodynamics Tutorials
  - Tutorial questions for thermodynamics
- Learning Maps (HIDDEN FROM STUDENTS)
- How to......
  - This folder provides a set of notes that describe how you might tackle specific areas of your F&T studies. Much of this information will be useful elsewhere too.
- Thermo Lab stuff
- Fluids Lab Folder
- WATS
- Quizzes

Quizzes

- Audio recording of Thermodynamics review lecture - 0.9kb

Exam Papers

- Search Voyager for previous exam papers

Support Information
Fluid Mechanics and Thermodynamics.  

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<thead>
<tr>
<th>Student Number</th>
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<tbody>
<tr>
<td>Print your name</td>
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<td>Hand out date</td>
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Q1a) A fluid of relative density 0.90 flows through a pipe of diameter 110 mm at 0.35 m/s. After passing through a gradual reducer the fluid leaves a 60 mm diameter pipe and discharges onto a stationary surface. Assuming that the surface slopes at an angle of 'A' degrees from the horizontal plane, as shown below, and that the surface somehow acts as a vane in that the fluid is deflected along its surface - calculate the forces acting on the surface for the angles shown in the answer boxes. You may assume that friction effects are negligible.

![Figure Q1a. Definition of angle 'A' for the inclined surface.](image)

| A = 90°  | N  | 1 Mark |
| A = 23°  | N  | 2 Mark |
| A = 31°  | N  | 2 Mark |
| A = 71°  | N  | 2 Mark |

Q2. 10 l/s flows through a contracting elbow which has an angle, 'A' of 27° i.e. as shown in figure Q2. Assume the inlet to the bend is 287 mm diameter and the outlet is 85 mm diameter and that the pipe lies in the horizontal plane. The static pressure at the pipe inlet is 4.90 Bar and the fluid's specific gravity is 0.84. Calculate the net force and the direction of the force.
Feed-forward to staff (Just-in-Time-Teaching)

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<td>100</td>
<td>79</td>
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- **LNB** is down 2 places
- **POM** is up 7 places
- **COL** is up 0 places
- **JOR** is up 0 places
- **BGR** is up 5 places
- **MDA** is up 5 places

- **LAO** is down 1 place
- **BOL** is up 0 places
- **CAE** is up 0 places
- **COM** is up 0 places

Bar chart showing data with different values and color coding for different categories.
Interesting, but what about the conversation?

In your own words describe the temperature change graphs.

What one area / topic / thing would you like further help on?

Often in manometry we ignore the density of the fluids in one of the limbs – why is this?

Please state which question was the most difficult and why.

In your own words describe Bernoulli’s Equation.
\[ F_{O5} = F_B \]
\[ F_B = 39240 \times 0.5 = 19620 \text{N} \]
\[ F(2.16 - 1.2) = H_2 \cdot 1.6 + F_B \cdot 0.8 \]
How do we know we have achieved our objective? – student feedback.

_Elluminate_: “first and foremost WOW, i’m a 2nd yr A2 and i failed this module. why couldn’t we have this test run last year?? been watching though them, so far its great. will we get this kind of technology for 3rd years, well if i don’t fail this year:) basically i love it.”
# Discussions

Please tick the box that best describes your use of this module's Discussion forum.

<table>
<thead>
<tr>
<th>Option</th>
<th>Percentage</th>
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<tr>
<td>i) I don’t read it.</td>
<td></td>
</tr>
<tr>
<td>ii) I find the questions and answers on the discussion forum useful</td>
<td>50 to 60%</td>
</tr>
<tr>
<td>iii) I DO NOT find the questions and answers on the discussion forum useful</td>
<td></td>
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50 to 60% of group rated discussions as useful
How do we know we achieved our objectives - Final Examination Marks

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<th>2002 (WATS)</th>
<th>2003</th>
<th>2004</th>
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<td>47.1</td>
<td>42.2</td>
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<td>Median %</td>
<td>34.0</td>
<td>48.0</td>
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<tr>
<td>Standard deviation</td>
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<td>23.7</td>
<td>21.3</td>
<td>22.6</td>
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<tr>
<td>%&gt; 34%</td>
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<tr>
<td>Pop.</td>
<td>127</td>
<td>128</td>
<td>133</td>
<td>163</td>
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</table>
How much did it cost?

Increased income through improved student performance resulting from the use of Blended Learning - improved student retention.

Potential of increased cost due to additional preparation time – importance of “fit for purpose”
An example: Enhancing efficiency and effectiveness of lab introduction via Elluminate

8 x 2 hour lab sessions. The sessions are attended by around 20 people.

The lab is fairly straightforward – and low risk

Previous students appear to struggle applying theory to real world systems.

Staff time is very limited
Solution

• Used Elluminate to record the introduction.
• The actual lab activity is now open access – it does not need a member of staff.
• Allows smaller groups – hence better learning experience
• The intro. took about 50mins to prepare and 40mins to create a 40 min recording (1.5 hours total).
• Staff time SAVING - 14.5 of 16 hours (minimum) i.e. a saving of 90% .
• Also used this technique for revision classes – students are very positive about the approach.

Opportunities for further developments:

• Simulations:
• On-line labs.
• Industry input (case studies) – through Elluminate, podcasting, multi media materials ……
• Student expectations of using technology: