# *Using technology in the module delivery of mathematics*

**Alison Hooper, Karen L. Henderson & D. Rhys Gwynllyw**

UWE Learning and Teaching Fellows

Department of Engineering Design & Mathematics

University of the West of England, Bristol (UWE).

University of the
West of England

BRISTOL

bettertogether

# Outline of talk

1. **Lecture Delivery**

2. **Student engagement with lectures (Turning Point)**

3. **e-Assessment**

bettertogether

# Lecture Delivery

- **Reasons for change**

  **1. Loss of Boards**

  **2. Timetabling Issues**

  **3. Lecturing large groups (Engineering Maths 300 students, 1st year)**

- **Delivery Strategy**

  **1. Lecture delivered writing on a Tablet PC**

  **2. Lecture recorded using screen capture technology**

  **3. Lecture Recording posted on module VLE immediately after lecture.**

- **Equipment**

  - **Tablet PC  (HP Elite Book)**
  - **Screen capture software (Camtasia)**
  - **Annotating software (PDF Annotator, WordOffice OneNote)**
  - **Roving microphone**

  **Video**

  https://share.uwe.ac.uk/sites/fet/LIU/Pages/Home.aspx

- **Advantages and Disadvantages**

  - **Students like it**
  - **Latecomers, absent students can catch up**
  - **Helps with revision**

  - **Students may not attend.**
  - **Technology can fail – power cut out**
  - **User must be competent with the software.**

# Student Engagement: Turning Point

- **Availability**
  1. **Hand-held voting devices (clickers) installed in three UWE lecture theatres,  (capacity 250)**
  2. **University owns about 8 bags (32 clickers, one dongle)**
  3. **Faculty purchased 4 bags.**
  4. **Faculty purchased TP software to run with smart phones**

- **Cost**

  **Clickers (about £40 each)**
  **Cannot purchase dongle alone**

- **Difficult to implement**
  1. **Must ensure TP open before creating a PowerPoint quiz**
  2. **Check quiz with dongle and clicker before using with students**
  3. **Always have a plan B**

# Turning Point

- **Calculus and Numerical Methods (50 first year students**

- **Engineering Maths (300 first year students, clickers built-in to lecture theatre)**

- **Complex Variables (less than 25 second year students)**

  - **Use my own tablet with TurningPoint dongle**

  - **Run the questions at various times**
    - **Start – checks understanding from previous lectures**
    - **During – breaks up lecture**
    - **End – checks understanding of current lecture**

# Student Engagement: Turning Point

- **Turning Point Dash Board**
  - **PowerPoint Polling**
  - **Anywhere Polling**

# Turning Point

- **Engineering Maths (300 first year students, clickers built-in to lecture theatre)**

    - **Use my own tablet with TurningPoint dongle**
        - **Can start the quiz as soon as I arrive**
        - **No problem with software version control**

    - **Start the lecture with at least one question**
        - **Can use the extra time before the start of the lecture to good effect**
        - **Still takes time out of the lecture**
        - What to do after depends on correct response rate

The forced response (PI) of
$$y'' - 4y' + 5y = 15t - 7 \text{ is}$$

A. C exp(−3t)

B. 15t -7

C. 3t + 1

D. 3t -7/5

E. I don't know

- Sometimes use short questions during lecture
  - Breaks up the monotony of the lecture!
  - Takes time out of the lecture
  - Logistics of moving between pen mode to laptop mode

- **Calculus & Numerical Methods (50 first year mathematics students, hand out clickers at the start of the lecture)**

  - Not used as much, partly due to the above barrier

  - 12 question quiz to be done in lecture at own pace (collect results via TP)
    - Students can work at their own pace
    - Lecturer can go round and help where necessary
    - Time-consuming to collect responses (7 mins)
    - Feedback concentrated on "harder" questions

# Student feedback:

"I particularly enjoy the use of turning point in the classes, which breaks up the lecture by providing **a different method of learning**. It creates a bit of competition to see who can get the correct answer to each question and is an **enjoyable change to the normal structure of a lecture**."  (Mathematics student)

**Please comment on the best aspects of the module:** "Doing examples of problems in class and the keypad questions before the lecture starts."  (Engineering student)

**What changes would you recommend could be made to this module?** "More turning point questions to **keep people alert** and **check everything's going in**." (Engineering student)

**70% of students** found the TP questions to be "**Very Useful**" or "**Useful**" for their learning processes.

# e-Assessment

- **E-Assessment used in Maths department for more than 15 years.  QMP and then DEWIS.**

- **DEWIS** is an <u>algorithmic</u> e-Assessment system.

  - Designed and developed at UWE, first implemented in 2007 and it is supported by the university. A completely stand-alone web based system for both summative and formative assessments.

  - Primarily designed for numerate e-assessments; at UWE currently used for formative and summative assessments in the fields of:

    - Business
    - Computer Science
    - Engineering
    - Mathematics
    - Nursing

# Calculus & Numerical Methods (50 first year students)

Four small e-Assessments throughout the year covering the whole syllabus. Typically each contain 10-15 short mathematical questions.

***Practice mode:*** Students can access the tests anonymously as many times as they like prior to the summative e-Assessment going live.

***Assessment mode:*** Students are given 2 attempts over an 11 day period to attempt the test. Their mark and full feedback available immediately after submission and their highest mark counts. *(Practice tests switched off).*

All four e-Assessments are re-opened for one further summative attempt at the end of the year.

***Revision:*** All four practice tests re-opened for revision purposes prior to the exam in May.
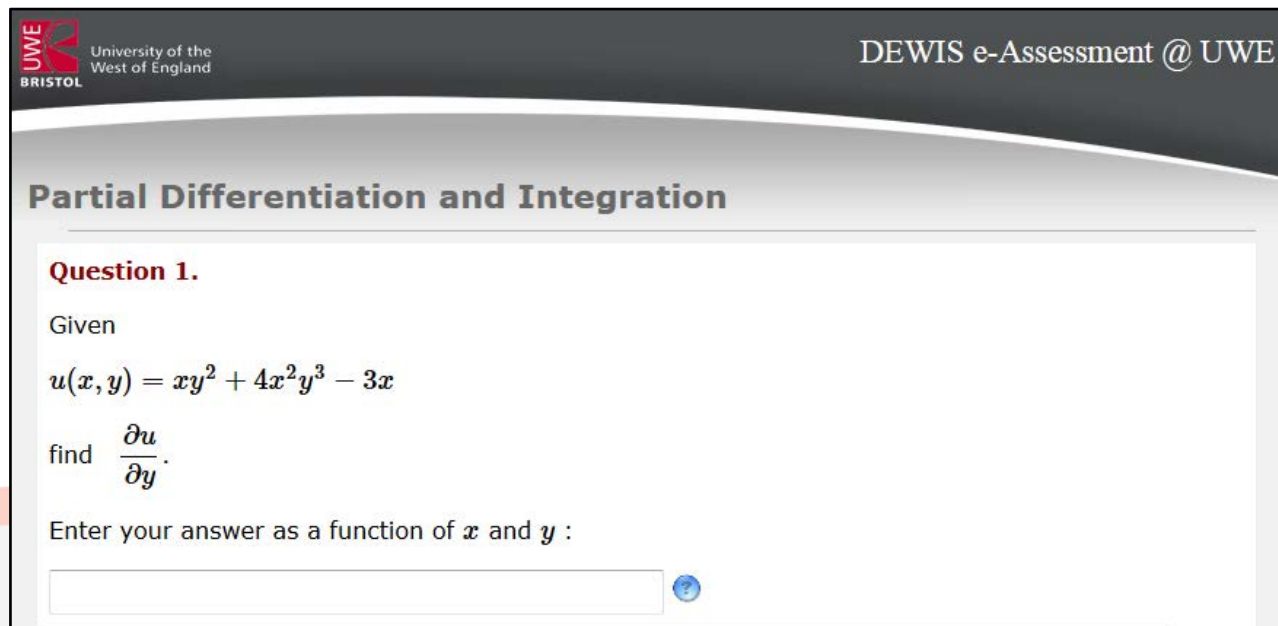
# Engineering Maths (300 first year students)

Similar to Calculus & Numerical Methods, but with six small e-Assessments throughout the year covering the whole syllabus.

*Practice mode:*

**2012/13 (practice tests mirrored the e-Assessments)**

**2013/14  (weekly practice tests, selected questions ->  e-Assessments)**

University of the West of England
UWE BRISTOL

DEWIS e-Assessment @ UWE

## Partial Differentiation and Integration

**Question 1.**

Given

$$u(x,y) = xy^2 + 4x^2y^3 - 3x$$

find $\dfrac{\partial u}{\partial y}$.

Enter your answer as a function of $x$ and $y$ :

# Student feedback:

**92% found the DEWIS tests useful**.

**Please comment on the best aspects of the module.**

- *The online tests have been very enjoyable, while putting me under some pressure they have been good practice, but also allowing me to get a few extra marks before the exam has been a massive positive for me .*

- *Being given feedback after the online tests has really helped me learn the processes as well as having practice tests.*

# Results:

- Marked improvement in pass rates since practice tests using DEWIS introduced (2010/11).  *Students learn from e-Assessment feedback: Greenhow & Mundeep (2008)*

- *However no noticeable improvement from using mirrored practice tests to weekly practice tests.*

Practice test usage (2012/13)
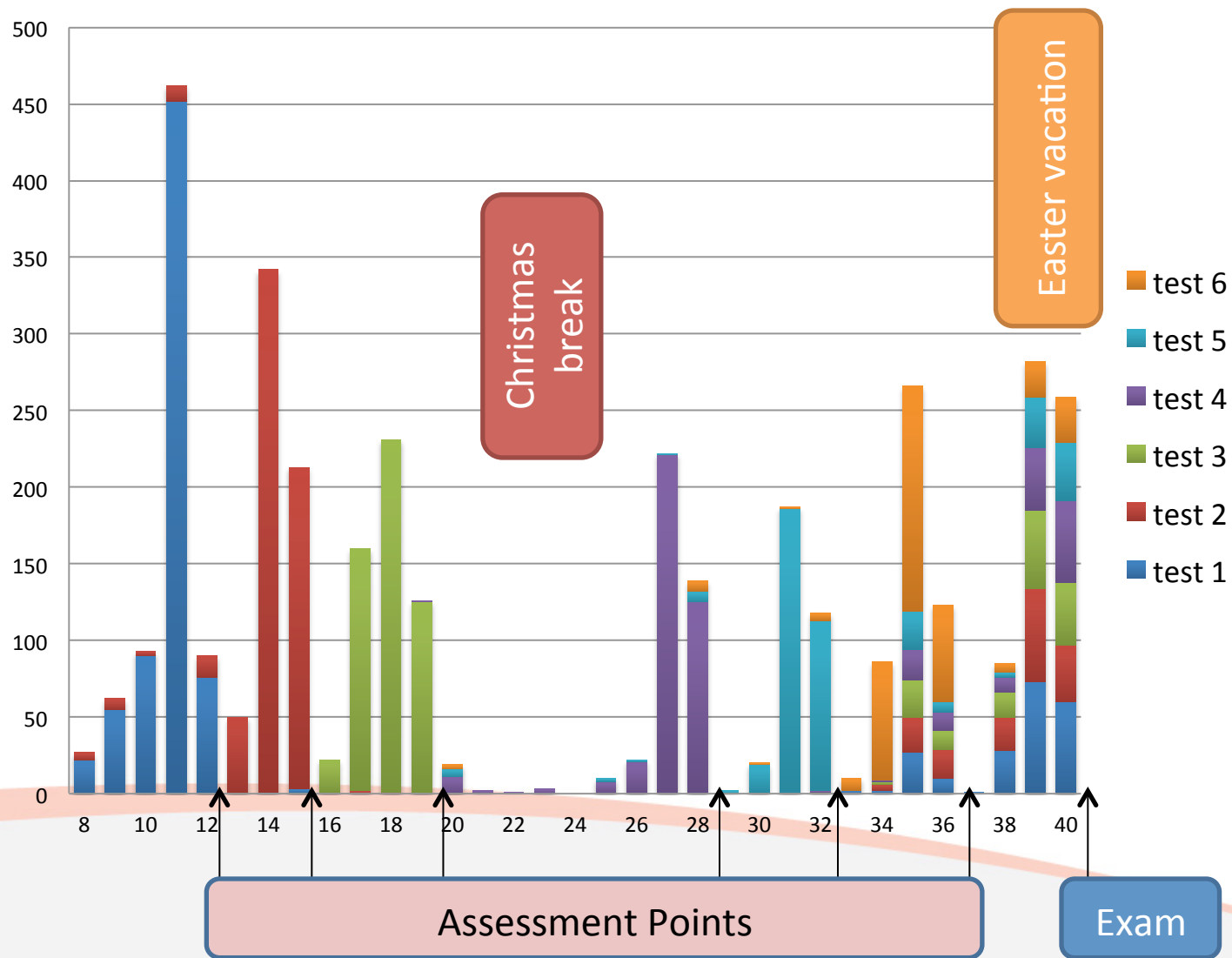
# Comparison of practice test usage for 2012/13 and 2013/14

| practice test | 2012/13 | 2013/14 |
|---|---|---|
| 1 | 695 | 863 |
| 2 | 640 | 518 |
| 3 | 535 | 390 |
| 4 | 393 | 272 |
| 5 | 334 | 321 |
| 6 | 312 | 218 |
| total | 2909 | 2582 |

Number of practice attempts, prior to each assessment.

2013/14 averaged over the relevant weekly tests.

Apart from for the first test, less practice attempts in 2013/14 despite higher student numbers.

bettertogether

# Plans

**Delivery**

- **Divide lecture into topics and make 10 min (or less) recordings of topics which are posted up for study before the lecture**
- **Use lecture to go over salient points – engage with the flip lecture approach**

**Turning Point**

- **Deliver using Turning Point Anywhere**
- **Construct library of suitable Multiple Choice questions for delivery with TP.**
- **Use TP better in lectures, specifically Engineering Mathematics and in Calculus and Numerical Methods**

# Plans

**e-Assessment**

- **Monitor practice usage – no longer anonymous access – tutorials will be geared round the online practice test questions. Tutors will have access to data for their tutor group.**

- **Introduce a mid-term online test, under exam conditions, for Eng Maths.**

- **Introduce weekly practice tests for Calculus & Numerical Methods and select several questions from each week to form the summative e-Assessment, as for Engineering Maths.**