Experiences of adopting and developing an e-assessment system

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10 September 2013

Section 1

Background

Leeds and e-assessment

Problem Enthusiasts never stay around long enough to get a system moving!

Goal School management wants something sustainable

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Outcome	School adopts Dewis

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Development Strengthen the project through involving a second institution

Section 2

Getting running

Adoption of Dewis

Diagnostic School of Earth and Environment

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	Mathematics 2 (ordinary differential equations)
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In all, seven staff (including PJW) seeing it in action

Year one overview

- Focus on making Dewis easy for staff to start using
- PJW to code new questions and administer assessments
- Questions serialised from written assignments
- Variety of assessment schedules trialled
- Mid-semester quiz under light exam conditions

Section 3

Developments in-year

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Example Dewis will happily evaluate $(-1)^n$ and $\cos n\pi$ and obtain the same answer.

The question

Find the Fourier series coefficients a_0, a_n and b_n for the function

$$-6 + 9x + 3x^2 + x^3,$$

in the range $-\pi < x < \pi$.
(Calculate a_0 to 1 decimal place.)

The potential

- Direct assessment of Fourier series calculations
- Power and Frobenius series solutions to ODEs
- Basic financial mathematics

Constructing polynomials from samples (L1)

Let $p(x)$ be a polynomial of degree 3. Its derivatives, around the point $x = 2$, are as follows:

$$p(2) = 4;$$
$$p^{(1)}(2) = -10;$$
$$p^{(2)}(2) = -18;$$
$$p^{(3)}(2) = -12.$$

What is the value of $p(1)$?

Sturm-Liouville operators (L2)

Consider the following differential equation:

$$x^7 \frac{d^2y}{dx^2} + \left(3x^6 + 4x^7\right) \frac{dy}{dx} + x^2 e^{-4x} \sin 4x \cdot y = \lambda y.$$

This can be put into Sturm-Liouville form,

$$\frac{1}{r(x)} \left[\frac{d}{dx} \left(p(x) \frac{dy}{dx} \right) + q(x) y \right] = \lambda y.$$

By carrying out suitable calculations, identify the functions $p(x)$, $q(x)$ and $r(x)$.

Fourier transform (L2)

Using the definition of the Fourier transform in which

$$\mathcal{F}[f] = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} f(x) e^{-ikx}\, dx,$$

you may take it that if

$$f(x) = \sqrt{\frac{\pi}{2}} e^{-|x|}$$

then

$$\hat{f}(k) = \frac{1}{1+k^2}.$$

Using this fact, and also facts about the Fourier transform from lectures, find $\hat{g} = \mathcal{F}[g]$ (as a function of k) if

$$g(x) = 2\sqrt{\frac{\pi}{2}} e^{5ix-|4x|}.$$

Section 4

Outcomes

Improvements in exam performance

	Reference	Treatment
Exam average	66.5	66.6
Exam st. dev.	15.7	21.9

[1] Marked out of 20.

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- Why the marked increase in standard deviation? (I don't know!)
- What drives the increase in Q2 performance?

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An improvement in engagement?

Engagement with written assignments was far better

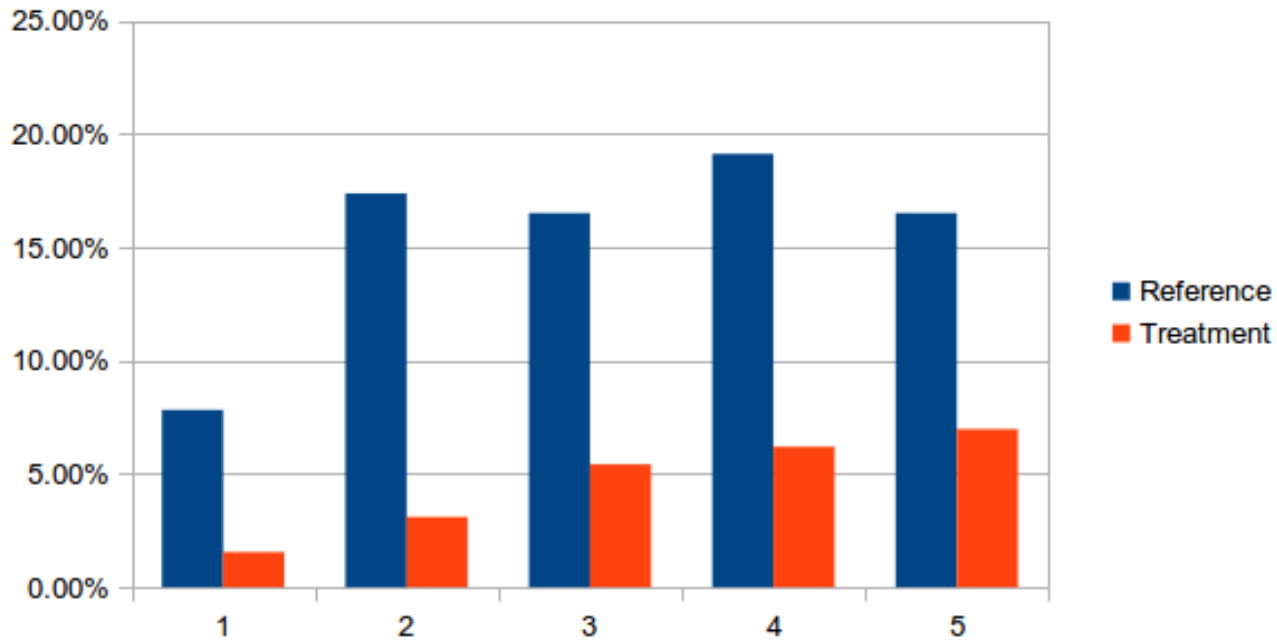

Figure: Absenteeism from written assignments.

An improvement in engagement?

Engagement overall was much the same

	Reference	Treatment
Ave. written	84.5%	95.3%
Ave. CAA	N/A	77.7%
Ave. all	84.5%	85.1%

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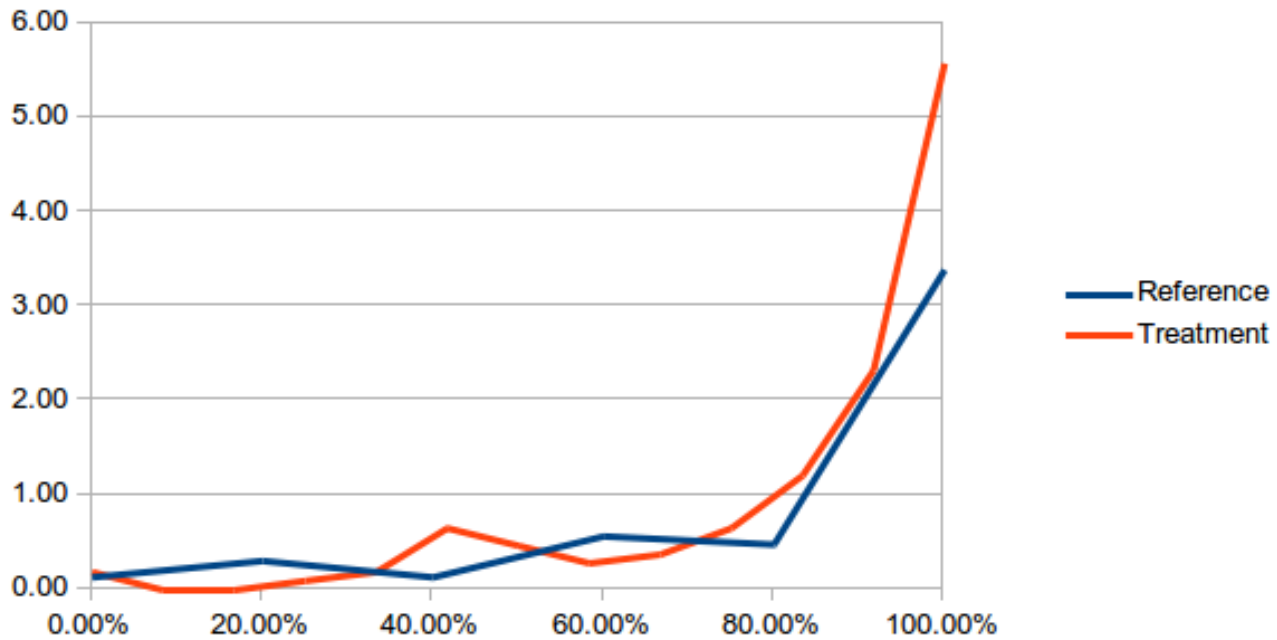

Figure: Engagement with all assessments.

Back to question 2

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Written assignment 2 was relevant to question 2

	Reference	Treatment	
With written	12.2	13.8	*

Table: Performance of students sitting relevant written assignment. * means differs from reference cohort at $p < 0.01$ level.

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	Reference	Treatment	
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Table: Performance of students sitting relevant written assignment. * means differs from reference cohort at $p < 0.01$ level.

We conclude that the increased engagement with written coursework is not the only determinant of the improved performance in this instance.

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We conclude that engagement with the e-assessment is correlated with improved examination performance. We cannot exclude this being solely due to the 'time on task' factor.

Student feedback

- "I thought that the e-assessments were extremely helpful in reinforcing knowledge and allowing practice of the material - all modules should have e-assessments."
- "the unforeseen issues[2] with the e-assessments at the beginning was an annoyance but that happens"
- "the e-assessments are generally a very good idea and useful for homeworks/revision"
- "The e-assessments although they helped but I found the effort that was put in didn't really merit the marks received"

[2] Gremlins.

Section 5

Looking forward

Where are we going?

- International Foundation Year: integral calculus and maybe others
- Level 1 Financial Mathematics

What are we changing?

- Move from regularly-scheduled assessment in Level 1
- PJW to move towards acting as support for staff users
- Adding in continuation marking
- Still working out how to balance written and online assessment

Detecting and diagnosing common errors

1. Define a correct answer and a table of incorrect answers which are based on predictable errors
2. Test against these answers (STOP if student is correct)
3. Raise a flag whenever the student hits an incorrect answer

We can use this algorithm

- to identify when a student makes a certain error, and
- to display some appropriate feedback.

Certainty-based marking

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Solution Students assess their own level of certainty

We ask students how certain they are

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Further How does this interact with repetition aspect of CAA?

How can we administer this using Dewis and Blackboard?

Adaptive feedback

Combines the previous two developments:

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$$\begin{aligned} \text{content of feedback} &\longleftrightarrow \text{error(s) detected} \\ \text{quantity of feedback} &\longleftrightarrow \text{certainty level} \end{aligned}$$