

## Guardian Awards Application

**Teaching excellence.** Awarded to an outstanding teaching initiative that inspires student learning and attainment through innovative pedagogy and champions the importance of university teaching.

### 1. Project Outline

*Outline the project, its place within your university's strategy and what makes it innovative and inspiring (max 300 words).*

Last year we scrapped lectures in one of our large first-year engineering maths courses. In their place we developed an integrated format of specially filmed short videos, personalized online quizzes and twice as much small-group learning. This radical change solved historical engagement problems and resulted in highly motivated students who significantly outperformed their traditionally taught peers.

We are excited by how well our approach worked. On average, students attended three times as many problem classes over the year than those on the traditional format. Exam marks were 5% higher and the proportion of bad fails reduced by a factor of three. Overwhelmingly, students were happy with the course and, when asked what was good about it, commented "EVERYTHING. I love this style of teaching" and "this module is very well done, especially with the usage of online lectures and problem classes, which deeply help my understanding of the taught material".

Students develop a "sense of freedom in learning" and praise the "very engaging" classes led by "lecturers that are specialised in the subject". Videos "replace having to be taught in lectures... instead [students] can use the time in the classroom with a teacher". Students find them "very useful as you can watch them multiple times, anytime you want" and feel they "greatly improve the productivity of study". The learning-environment is "really impressive and useful" and the flexibility of the format "allows students to learn when they are most motivated... an invaluable resource".

Our university aims to stay at the forefront of developing new means for supporting learning, and our approach demonstrates how up-to-date technology can outperform a centuries-old tradition. Our integrated format is novel, cheap and easily replicated. Its success provides a new model for science, engineering and mathematics teaching across the sector. (291 words)

### 2. Project Delivery

*Detail how the project was delivered, from the planning stage through to its successful conclusion (max 300 words). Include details of timing and funding.*

We developed 108 ten-minute video lectures, 108 short online quizzes and 40 structured problem classes, using the same supplementary course notes and exercises as the traditional format. We established an online discussion board and delivered 5 full-cohort lectures across the year. The videos and tests are accessed through the

Assessment in Mathematics (AiM) learning-environment mostly developed at our department.

The unfunded project was a collaboration between Mathematics and Mechanical Engineering. Planning and preparation took place in summer 2013 and the module ran for the first time that September.

In a standard week students complete two iterations of the cycle: log in to AiM > watch 3 videos > rewatch if necessary > complete the quizzes > attend a problem class. Additionally, students work on practice exercises independently, supported by the course notes and staff or peers on the discussion board.

Problem classes are at the heart of the course. Each group of 40 students meets their tutor twice a week. The tutor recaps and reinforces the theory seen in the videos, encourages input on an example demonstrated at the board, then stimulates small-group discussions on problems designed to provoke thought.

The recording of videos needed minimal equipment (camcorder, lapel-mic, umbrella lights and blackboard in a standard office). The team of eight teaching staff had little experience of video-making. Each developed their own style, mostly 'chalk-and-talk', but cutaways to narrated slides also featured. Youtube hosts the videos which then appear embedded on a page within AiM preceding an online quiz.

AiM handles sophisticated mathematical questions, randomly varied by student, and the underlying software is able to manipulate algebra so as to accept any valid rearrangement of a correct answer. It also gives instant feedback on student responses and records all activity, allowing us to track engagement and performance.  
(293 words)

### 3. Project Outcomes

*Outline the project's outcome(s) within the university and beyond with relevant supporting evidence, metrics or testimony (max 400 words). Please note that we are not accepting attachments or appendices and any evidence provided should be included in the word count.*

The data we have strongly supports the success of our approach. Our format will be extended from 240 students in 2013-14 to 600 in 2014-15 and 1000 in 2015-16. A pedagogical paper is in preparation and we have received interest in our methods from two neighbouring institutions.

We compared engineering department A on our new format with departments B and C on an identical syllabus taught traditionally. All sat the same exam. Student numbers were large (85-240 in each cohort) making the data robust.

== Attendance ==

Students attended three times as many problem classes across the year, with a higher attendance rate over twice as many scheduled classes.

Dept.	Ave. attendance rate	Ave. no. classes attended
A	77%	31.5
B	50%	7.5-11.5*
C	59%	10-12*

(\* missing data at end of course)

#### == Exam Performance ==

Statistical analysis of data for the three years to 2013-14 indicates that our approach adds 8 marks (with a confidence interval of 4 to 12 marks) to the expected grade of a student. The linear model used controls for differences in exams year-on-year and performance trends across departments.

We see most effect at the bottom end, with the proportion of low marks much improved.

Exam data for 2013-14 is below. (Final module marks included coursework, so the data does not represent overall failure rates.)

Dept.	Exam average	Marks below 40	Marks below 30
A	58.4%	11.4%	3.8%
B	53.1%	23.6%	11.2%
C	48.1%	31.6%	11.8%

#### == Video Completion ==

Half of students had a near perfect video-watching record, completing at least 97% before the deadline, and the vast majority of students (86%) watched at least 80% of the videos on time. Students could watch missed videos right up to the exam.

#### == Student Satisfaction ==

Over 92% were satisfied or very satisfied with the course in the end-of-semester questionnaires (198 responses). Additionally,

- 115 of 168 comments mentioned online videos when asked what was good about the module;
- only 5 comments suggested traditional lectures would improve the module.

Similarly high satisfaction rates for the traditionally taught courses did not translate into comparable engagement or exam performance.

#### == Conclusions ==

The data indicates that our approach significantly improves student engagement and attainment and enhances the student experience. Our innovative, low-cost model can easily be applied by other higher education institutions to large cohorts in the theoretical sciences and beyond. (395 words)