

## 21st Century Engineering with Historical Perspective

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Tutor in Study: Gary Lock, Department of Mechanical Engineering, University of Bath  
Subject Area: Fluid Mechanics  
Study Completed: February 2005

This case study has been developed from data gathered through a demonstration of the teaching and learning materials available, interviews with the tutor, student questionnaires and focus group.

### Background

Fluids Mechanics with Historical Perspective is part of a series of modules covering the broader subject of thermodynamics at the University of Bath. At the start of each hour long lecture the tutor gives a 15-minute input on an aspect of the discoveries and developments related to flight. This historical background usually consists of a five-minute power point presentation, followed by a short video clip providing the context for the formulae and calculations that are to be explained in the lecture. For example, at the start of a lecture on compressible flow of gases, the presentation is on the story of the first supersonic flight. The tutor has developed 24 'mini history lectures' to accompany the lecture series which he hopes will make this largely theoretical based subject more interesting for his students. The lectures are supported by a set of notes given out at the beginning of each topic. The notes include visual images, as well as brief notes on the historical perspective shown and the theoretical concepts explored. The notes are not, however, complete and students are expected to bring them to the lecture each week to "fill in the blanks".

Students from all disciplines in the department, which include mechanical, aerospace, automotive and manufacturing engineering, are taught together in their first and second years, giving approximately 150 students studying thermodynamics. This module is taught over 24 lectures in semester 2 and supported by weekly tutorial sessions. The department prides itself on the high mathematical content of its degree courses and all students are required to have studied maths and physics at A-level.

### Reasons for introducing this teaching method

As the tutor is enthusiastic about the subject, he enjoyed developing the new material for the lectures. A large collection of materials has been developed over a period of time, and the improved access to resources via the World Wide Web has helped to develop the library further. "Remembering back to the lectures that I enjoyed at university, I wanted to add something interesting to these lectures".

Students traditionally regard mathematically based subjects as difficult. The tutor aims to expose students to the "colourful history" of engineering through the use of videos and images in the lectures, and it is hoped that seeing real applications will help students to understand the fundamentals of the science and mathematics being taught.

### Students' perspective

Overall the students felt that the inclusion of the historical examples made the course more interesting and welcomed the inclusion of "real examples of theory in action" making the theoretical elements "easier to understand". They felt more motivated and were keen to learn because they had more interest in the subject. Students noted that the "turnout seems better

in this module than some others". Just 12% of the class felt that more time should be spent on core theory, with others requesting more videos to be included, and more "descriptions of the theory in physical terms", possibly developing the inputs to also including some examples of more recent developments. Students also commented on the lectures expanding "beyond just engineering into social and political issues", with the tutor being happy to discuss the impact of engineering on society.

Students appreciated the clear structure to the lectures. "There was a fundamental structure to everything that he did, and you knew that each lecture was going to have a certain amount of learning and a certain amount of putting things into perspective". They also felt that the course had been developed so that new theory was introduced evenly throughout the lectures and that their knowledge was built up over time. The students who attended the focus group highlighted the appropriate pace as a significant benefit and would welcome better pace and structure in other modules, even where videos and images were not available.

The tutor produced "good quality notes" which were seen as a "really good read". Students thought that the gaps in the notes made them concentrate in the lectures. The reference sections in the notes helped if they wanted to learn more or go back over theory, and as the notes were illustrated with pictures and anecdotes, the students were more likely to read through them again. Students commented, "the notes were structured and up to date – so many times we have notes which don't match the lecture because something has changed since last year."

This year has seen the introduction of PowerPoint to deliver the lecture and this has proven useful in keeping the lectures and notes up to date. The tutor has won several university teaching prizes and has used the small cash prizes to fund a laptop to run the presentations and to pay for a student's time to source appropriate electronic images and videos. Some videos and images are covered by copyright and it can take longer to find freely re-useable media. Using different types of media in the lectures can also mean that additional AV equipment has to be booked in advance.

Some of the students commented on occasional problems with the AV or the reproduction quality of some the videos and images, and thought that this could be improved to avoid loss of lecture time.

## **Benefits**

Overall the students thought that they remembered more of the material because the theory had been given relevance. "I remember the dimples on the golf ball and how the cricket ball travels and stuff. I remember that from the first lecture." The students seemed to have engaged more with the teaching and commented that lectures had "inspired conversation afterwards with friends." They had also been able to use the theory in other areas: "The nice thing about that as well is when you are doing other courses, when you're doing concepts and things, it has stuck in your mind so you can bring it up."

The tutor is an aerospace engineer so many of the examples used are about the history of flight and it is hoped that students who might not previously have thought of opting to take aerospace engineering at the end of the 2nd year, may now consider the subject because they are more aware of some of the achievements of the discipline.

Large class numbers can make it difficult to motivate and enthuse students due to the lack of individual contact. The tutor has encouraged students to complete the student feedback questionnaires distributed at the end of the module and prides himself on how well this

simple approach is received by the students. “It has achieved what I’d hoped because I am still as enthusiastic and excited about a as I was when I began. I still get a buzz, especially from a big class.”

The students commented that the tutor was “clearly enthusiastic about subject” which in itself improved the lecture and they appreciated the extra effort the tutor had gone to: “I look forward to these lectures!”; “The best lecture series I’ve had. Makes me want to do the work!”

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