Steel and the Class of 60,000 Students

I teach some 60,000 students each month on the subject of steels. The task is relentless, and yet, I find the time to relax – for example by arguing with my French colleagues, or going to the cinema. And I watch the movies in style - the other day I went to Korea to watch *Slumdog Millionaire* and then blissfully slept for ten hours, wondering in my dreams about how such a gem could have been conceived. The movie is of course a fantasy, but the class of 60,000 is not.

I can speak many languages: English, Gujarati, French, and FORmula TRANslation. But there is one which I use the most -- it has no sound and yet speaks ever more loudly. I refer to the hypertext mark-up language commonly known as *html*, which renders pages on web browsers. It was in 1995 that Mark Manning gave me a kick start on this and I have never looked back.

The essential story is simple, that the web provided a method for publishing *teaching* materials which in the past would have festered in some dusty corner in a crowded professorial office amongst the models of crystals and precious pieces of shaped-steel. These notes would have been developed over many years of teaching, so converting them into the portable document format was easy. Next came the slide presentations and massive collections of images collected during academic adventures all over the world. The collection of materials grew into a veritable library containing complete textbooks courtesy of the publishers, movies of metallurgical processes, worked examples, computer programs, calculators, reviews, podcasts, factual reporting and a myriad of resources, all of which could be taken freely from any geographical location in the world at any time.
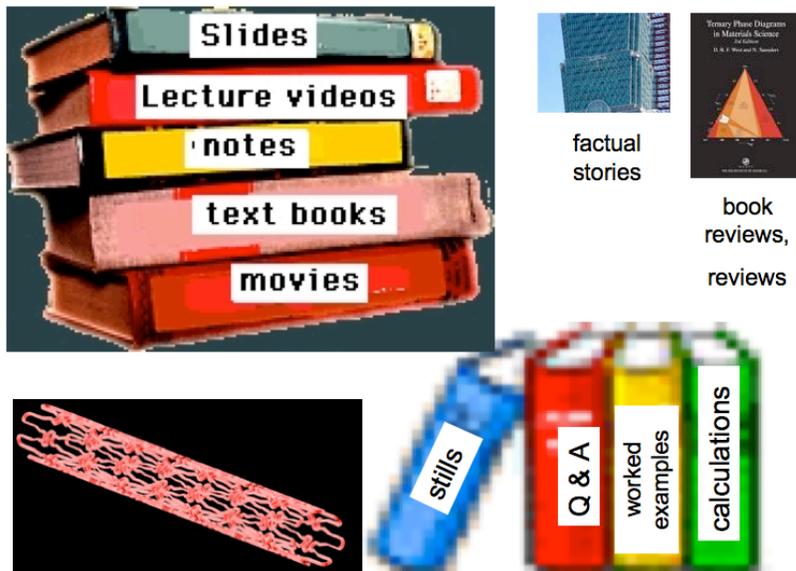
A friend donated a system to create a knowledge-base incorporating a Bayesian language model which after a while can automatically interpret and address repeat questions from students; any query the computer was not happy with would be directed

to a human, resulting in a knowledge base which is enhanced over time. In this way, some 90% of the queries are now automatically addressed.

The typically 60,000 students, access three times as many documents each month along with other formats (FIG). The access is free, anonymous and unlimited.

1,781,988
182,248
22,257 **32,357**
5,400
202,174

Documents Images Slides Movies Audio Others
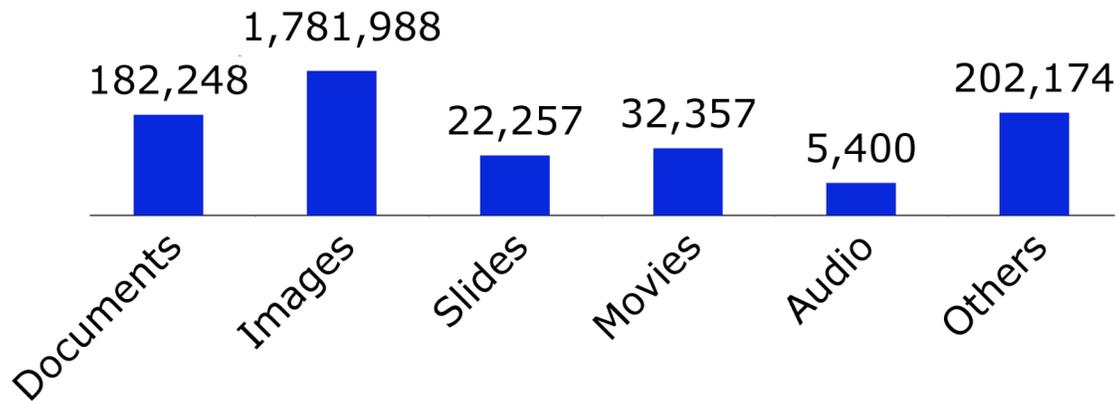
The transparency in making the teaching materials available has advantages. Any mistakes discovered in the contents are reported back and amendments made, perhaps making this the most comprehensive quality control system imaginable. There are complete courses which have been adapted and used by others; the materials are cited in research papers and the contents have appeared in magazines and scholarly articles.

Are there any problems with this approach? First, the dissemination of knowledge in this manner costs money since the University has to pay for internet traffic and this may become an issue of increasing importance given the bandwidth required for video outputs. The associated infrastructure also adds to expense. On the other hand, the costs are minimal compared with all the other outreach activities that we typically engage in to endear ourselves to the outside world. It is possible that the electronic content is especially susceptible to plagiarism but this is not something that concerns me. It simply means that the teacher must set tasks in such a way that the answers require creativity. For example, *State the Weiss zone law* can be replaced by the question *What is the condition for a direction to lie in a plane?* A google for the latter does not yield a sensible answer (check this for yourself).

There is of course, no way of assessing the performance of the 60,000 students. But a colleague of mine, David MacKay, whose passion in life is information theory, frowns at the ranking associated with examinations. He argues that all students should learn until they achieve an A grade, which should be the only grade available. After all, bus drivers are not ranked, they must all achieve the required standard.

How do I see the project developing? Many of the contents, such as the lecture videos, are amateur. The lecturer sometimes walks out of the field of the camera, and on occasions, a mobile telephone interrupts the train of thought. But this is a reflection of real lectures, and it would be unwise for normal teachers to spend time creating professional videos. Others, such as the Open University with its vast experience and resources, are much better at doing this properly.

Much of the evolution in this project has happened naturally as technologies such as video recording become cheap and widely available. Who knows what new methods will become routine on the world wide web? Academics are good at mastering challenges, so watch this space. Academics also do not use new methods just because they have been invented. The aim is to deliver the teaching materials effectively, without revealing the underlying technology and its associated nuts and bolts.

One snippet. My professorial office now looks empty. There are no shelves bursting with papers and folders, rows of filing cabinets or piles of journals. Most of my academic possessions are on minute devices and travel with me wherever I venture. Students can now emulate this using the teaching materials in electronic format and never be out of earshot from their work (!). With this, I end this tale but there may be a sequel at some stage – I hope there is one for the *Slumdog Millionaire.*

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