
Video comes of Age

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I first came across flexible learning at a conference in Nottingham in December 1976. I signed on for a study group on 'Self Paced Learning' which sounded intriguing. When I discovered it meant teaching without lectures I was immediately hooked because much of my own rather unorthodox undergraduate career (at Witwatersrand and Cambridge) had involved studying without lectures, or with very unhelpful ones. Fred Hoyle began his lectures on electromagnetism by announcing that he was going to ignore the existing syllabus, on which we were nevertheless to be examined, in favour of a new syllabus just agreed for the following year. I agreed with him that the existing syllabus was boring, but managed to answer a large number of questions on it in the exam, which was fortunate as I was totally defeated by Chris Zeeman's questions on topology which bore no relation to anything which had appeared in the lectures.

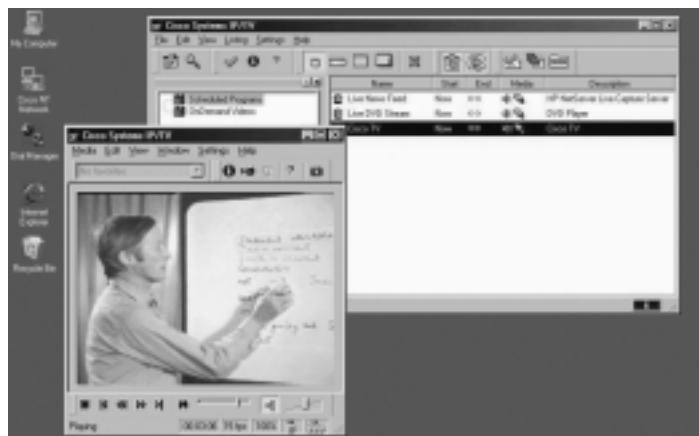
The conference started the day after a very long tiring term had ended: the most tiring element of which had been lecturing on calculus to a class of computer scientists who were slightly less knowledgeable (as measured by asking them to differentiate $\exp\{-x^2\}$ twice) at the end of the term than at the beginning. This had the natural result that I was very disenchanted with lecturing to them. The class had been given to me on my arrival as a new lecturer after they had gone on strike and refused to be taught by my predecessor, a very experienced applied mathematician, but they seemed a keen and intelligent if highly independent group and I felt convinced that there must be some way of getting through to them.

The following term I duly implemented the method suggested in the handout for the self paced learning study group (I never actually attended any of its meetings because I was so exhausted and demoralised by a night in the accommodation provided in a student residence that I bunked off the first morning). This was a modification of the 'Keller plan' originally based on methods used for weapons training in the US army: it was a method of teaching that was guaranteed to get the message across. As modified for use in British universities this involved writing 'units' for the students to read every week and giving them 'diagnostic' tests weekly, which were retaken after doing some more work if failed. In the original 'method' the tests were marked, and all instruction given by more advanced students, the lecturer merely supervising the instructors but this was not recommended for British Universities. I also introduced two programming projects, making the students generate contour lines for quadratic forms, to go in parallel with work on the units. To my gratification it worked beyond all expectations. From 40% the failure rate dropped effectively to zero and remained there. Every student who made a sensible effort at the projects passed. I found writing the units enjoyable, but the supervision of classes and diagnostic tests rather a chore, though it was a compensation that I got to know the students individually in a surprisingly short time, and, of course, that they were really learning something.

After a few years the computer science department got a new young trendy head who dropped the calculus (never to return) and set up a new course called Information Technology. He asked my department to put on a class in discrete mathematics for his 12 students. The request was declined, but fortunately I got to hear about it and offered to take it (being an algebraist it was up my street). I was asked to continue with the Keller method which had by now made a favourable impression on that department, though never, sadly, on my own. The module was such a success that I was given a further 50 computer science students for the following year.

One day the HOD casually suggested that I use video with my self-paced learning. I had a look at what the OU had to offer but found it unsuitable, so went to the 'audio visual' unit and asked them for help making my own videos. 'Quite impossible' was their initial reaction. However, on seeing that I was determined they became very helpful. I was fortunate in that the head, George Noordhoff a veteran of Dutch educational TV really knew what he was about. He suggested a format based on work by 'Sid' Urry well-known on the campus for his jazz band and his Building Technology students who were the dread of maths lecturers. The videos were very simple but clear and looked effective. There were two cameras, one on the lecturer and the other one on the output of an OHP showing the lecturer solving exercises just as one would in an examples class. I started making videos in this way, releasing them to the students as we went along. I was amazed by the results. Suddenly I heard my own words coming back to me and the students became reminiscent of Cambridge undergraduates who can be almost too slavish in their absorption of one's words of wisdom. This was something new indeed.

Now twenty years later with 324 students on my discrete maths course and 32 videos in the library for them to use, a dream has at last come true; last week I went to a demonstration at CISCO of their latest video streaming technology which allows, at comparatively modest cost, videos to be distributed over the campus network which includes all halls of residence. My VHS tapes (made so as to be legible even on rather the poor quality Video players I had seen in use at some Universities) came across the network perfectly, being digitised in real time, and were clearly readable even in quite small windows (the quality on full screen was also acceptable). The system also allows the students to ask questions or add comments which can be emailed to the lecturer or posted on a bulletin board. This allows for a wholly new level of interactivity which should greatly enhance the effectiveness of the videos. The system based of course on digital video, should also allow for user editing and updating of the videos, the lack of which has always been a major drawback. In fact all my videos have been made with no post production editing (I had to learn not to make mistakes). Experts have been scornful about



these videos. It has been suggested, for example, that they should all be computer generated, or perhaps voice over computer generated text. In fact George Noordhoff knew what he was about. His philosophy was that handwriting (as long of course as it was legible) and glimpses of the lecturer's face were very valuable to humanise the otherwise rather disagreeable experience of sitting in front of a screen trying to understand something difficult. In any case the videos have proved very effective over the years, and explain, I believe, why my self-paced learning course has flourished while so many others have bitten the dust. Indeed the only other long lasting one I am aware of is the first year engineering maths at Southampton where all 400 students on 20 different degree courses have taught by this method for well over 20 years. In that case it has been a major departmental initiative and very popular with the client departments (this has also been the case with my course though my own department has sometimes been rather grudging in its support). Ten years ago I gave a paper on the course at a conference

on first year University teaching. There were two Texans in the front row. "Sure they" said "we know it works, its just too costly". My point is that the video reduces the cost – of paying the instructors, in my case graduate students – because the tapes make the learning more effective and so allow the class size to be larger.

In recent years, as the class has shot up in size and the educational attainments of the students have diminished (Btech students seeming to know very little mathematics, polynomials being a problem and rational functions quite beyond their ken), the class average has gone down from 70% to 50%, but some of this I think is attributable to the fact that use has declined as the video tape is now seen as an anachronistic medium (especially when tapes can't be taken out of the library) and I have hopes that when students can call up the videos on the computer screens their use will go up substantially.

About fifteen years ago the success of the course led the computer science department to give me another 50 students on a 'Computers with Business' course which had no mathematical prerequisites. "Surely you don't expect them to take the same course?" I asked

incredulously. "Oh Yes we do" they replied. Coping with these students I decided that some computer aided learning was necessary. These were comparatively early days for CAL, long before TLTP was thought of. I got myself on a COMETT project 'scripting' a text written in Belgium for a fully computer delivered module at MSC level on Denotational Semantics aimed at professional electronic engineers. I was to provide the interface between the Belgians who had written 100 pages of conventional text and the Dutch educational software house who understood little of the content. I had to prescribe what each screen would look like. This turned out to be a very much bigger job than I expected; it turned into an absolute nightmare and eventually the project and I parted company with bad feeling all round. However I had learned the hard way about the difficulties of CAL and I turned this to good account when I got a grant to make my own material interactive. No-one would give me money to develop CAL, presumably thinking I could do it alongside my other duties (research etc! Needless to say developing CAL didn't count for promotion then, let alone for RAE, nor in my case even for TAQ, my efforts being wholly omitted from the department's submission to TAQ on the grounds that all my students were from another department). But I did

get a grant to make an interactive video disc; I carefully designed the software so that the non video component would run standalone as CAL, because I correctly foresaw that we would only ever get one IV station which wasn't much use with 200 students. The CAL has proved to be very effective; it is a complete standalone version of the text that the students were given to read with all the exercises fully interactive and appropriate feedback for expected mistakes. Sadly it is now in great need of updating, as though educationally effective, as proved by literally thousands of students who have benefited from it, the old DOS interface now puts students off and I have great trouble getting them to use it. So much so that this year I plan to have 2 hours of class time in a lab with them going through it under supervision, which never used to be necessary.

The moral of all this is that to make flexible learning work you have to take advantage of the latest technology, but if you do the results can be very rewarding. Incidentally I believe that video and CAL - which can now, at last be networked together - should be very closely tied to the text so that the students do not see them as something else to do, but as a real help with the text.