At the edge of chaos

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I suspect that a majority of readers will have either read Michael Crichton's book or seen Spielberg's film *Jurassic Park*. It was fascinating at a number of levels, not least for its vague plausibility. We all know about amber being fossilised tree resin, and we are familiar with the idea of trapped insects within it. It seemed not too absurd an idea that such insects might yield something of the DNA of the animals they must surely have sucked the blood from all those millions of years ago. It was a tantalising notion, made real by some typical Spielberg tricks and some terrific animatronics (the 'raptors' in the kitchen were particularly gripping, I thought).

And now you must read Crichton's sequel "The Lost World" in which one of the same characters appears. Dr Malcolm – the slightly loopy mathematician who was into chaos theory – reappears as the central character, only his interest in 'chaos' has been developed somewhat. He is now into 'complex theory', the study of how complex organisms evolve and (eventually) become extinct.

Conventional theories of extinction (he argues) are not satisfactory since they accentuate only one side of the equation. The argument runs that animals have to adapt to changing environments and those that are best able to adapt are the ones that survive, whilst those that don't adapt become extinct. This theory accentuates the need for continuous and dynamic change. But Malcolm argues that as organisms get more and more complex, they become increasingly unable to carry in their genetic programming all the information that the organism needs for survival. The organism therefore builds in some version of 'childhood' in which appropriate behaviours can be learned from skilled (fully grown) adult members of the species. This reduces the need to carry all the required information in the genetic structure – to emerge as 'instinctive' behaviour – and accentuates the role of 'learned' behaviour within social groups. And this in turn provides the counterpart to the conventional argument about extinction. For learned behaviour requires stable communities within which wisdom (for survival) can be passed from older generation to younger ones. As an illustration of this, the 'elders' of most human societies (prior to the age of books) were held in great respect for their wisdom.

So we now have both sides of the equation. We need dynamic change to avoid extinction, and yet – as we get ever more complex – we need stability and order to create the conditions in which we can teach the young in ways that avoid them becoming extinct. As Malcolm (i.e. Crichton) vividly puts it:

> "complex systems seem to strike a balance between the need for order and the imperative to change. Complex systems tend to locate themselves at a place we call 'the edge of chaos'. We imagine the edge of chaos as a place where there is enough innovation to keep a living system vibrant, and enough stability to keep it from collapsing into anarchy. It is a zone of conflict and upheaval, where the old and the new are constantly at war."

The edge of chaos. What a fabulous concept. Crichton has done it again. Just as dino-DNA seemed plausible, so too does the 'edge of chaos' ring true. At least it rings true to me, and never more so than when considering design and technology classrooms. In two quite different ways I think there are important lessons for us in this idea.

1 Design and technology teaching

The best lessons I have ever taught – and the best lessons I have observed others teaching – always teeter on the edge of chaos. Teachers establish projects that provide a degree of structure and control, but if this control becomes too pervasive it stifles and kills off the individual imagination and response of students. But alternatively, if the controls are too sloppy then student individualism reigns supreme and it is all too easy for things to descend into chaos and confusion. Good design and technology teaching exists on the edge, with just enough structure to hold things together but with enough scope for individualism to ensure that creative developments arise and are fostered.

There is a natural tendency for teachers to favour control, since it is (by definition) more manageable. And there are currently enormous pressures on teachers – from Ofsted amongst other conformist forces – to emphasise this control and to be sceptical and cautious about allowing too much scope for individual creative responses from students. The sorry saga of Chris Woodhead's love affair with Taiwan-style teaching is but one manifestation of this trend. The approach may (or may not) ensure better spelling scores in multiple-choice spelling tests, but it most assuredly does not create better responses in design and technology projects. Interestingly, Taiwan has recently developed its own version of design and technology – called 'living technology'. And they are anxious now to develop teaching and learning styles that are appropriate to it since they recognise that their previous practices (based heavily on teacher-controlled craft exercises) need to change. It will be interesting to observe these developments in the next few years. And we must keep Mr Woodhead informed.

It is a challenging role for teachers to live at the edge of chaos, but it is also necessary, not only for good teaching but also for the continuing health of the subject which will only evolve and develop when pushed and stretched by those who practice it. And this raises my second issue.

2 Curriculum development

It is not just lessons, projects, students and teachers that need to exist at the edge of chaos – it is also the curriculum as a whole. The curriculum needs to adapt and develop if it is not to become extinct (this is the imperative to change). But it also needs to be sufficiently stable that practices can be learned and shared (this is the imperative for stability within a professional community).

The emergence of design and technology over the last thirty years reflects an interesting blend of chaotic individualism and centralised conformism. Throughout the 1970s and early 1980s, the classroom roots of design and technology, coupled with idiosyncratic LEA approaches and the flexible rules of CSE examinations

(especially mode 3) enabled a whole series of different initiatives and approaches to develop. But the need for consolidation was increasingly apparent, and in the early 1980s the Secondary Examinations Council (the forerunner of SEAC) launched the 'National Criteria' initiative in which we were required to define ourselves as a single coherent entity. The resulting consolidation meetings in Notting Hill Gate were tempestuous affairs. There was blood on the walls as deeply held but conflicting views were argued. And in the end we emerged with a small group of subjects (e.g. CDT and HE).

I was asked at that point to write the new guide for CDT (the lurid orange job). And even as I was writing it I was aware of the danger of encouraging an unhealthy conformity in the curriculum and I insisted that the text should include the following observation:

> "...if the steady growth and development of CDT over the last twenty years has taught us anything at all, it is that to advance our thinking we must rely on the innovation and creative endeavour of teachers in the classroom ... without this possibility of innovation CDT will wither and die ..."

The issue here is the extent to which teachers regard the curriculum as fixed by others and given to them merely to implement; or conversely the extent to which they see their professional responsibility as including the continuous development of that curriculum.

Just as with teaching, so too with curriculum development, it is challenging and uncomfortable to exist in a constant state of evolution. But we would do well to remember Dr Malcolm's warning that the alternative to continuous evolution – at the edge of chaos – is extinction.