A dangerously digital world

Three events have occurred in the last couple of weeks and forced me to reflect on an interesting phenomenon. My attention has been drawn

- to a piece of simple apparatus for teaching technology in the primary classrooms of Indonesia

- to the design of the flight deck of the Boeing 737-400

- and to a small part of my lecture on "standards in technology" at the recent NEC exhibition.

Interestingly, the very same idea emerged in all three events at more or less the same time. One of the real bonuses of being in higher education – and supervising a number of very able research students – is that one gets to see and debate and benefit from the freshness and intensity of their endeavour. And the first two events arose from precisely these endeavours.

A student of mine is responsible for designing learning apparatus for science and technology in primary classrooms in Indonesia. He has done some fascinating development work – including some critiques of existing apparatus from commercial suppliers. He recently brought me an example of a commercially available piece; a digital thermometer with a flexible probe that could, for example, be placed in a water beaker to provide an almost instant 'readout' of temperature. It was ergonomically sound, aesthetically pleasing, technically accurate, practically durable – and it offended my student enormously.

His criticism was an **educational** one, concerning the level of detachment between the experience of temperature and the readout on the digital screen. He made the point that the number on the screen emerges as if by magic – with no direct or observable relationship to any physical phenomenon. And he contrasted this to a conventional analogue thermometer with which pupils can observe the mercury (or whatever) moving up and down a scale. In this analogue case, children can be given direct access to the understanding of temperature measurement through expansion and contraction, and if we calibrate the tube carefully we can use this to give us a reading of temperature. For young technologists, this is an important and generalisable piece of learning. I have for example seen it translated into a different setting and used for a weighing device (children stand on a platform and thereby squeeze a liquid up a tube to provide a weight measure).

This student was critical of the beautiful digital product precisely because of the sense of separation that it created. The number was just a number appearing on a screen – goodness knows how – and how would we know if it was wrong? It amounted to seriously decontextualised data and the device prohibited some important elements of learning.

There are of course some environments where instrumentation is absolutely critical to success – and even to survival. And the flight deck of a large passenger aircraft is a case in point. Landing such an aircraft, with all the multiple (and sometimes conflicting) parameters that surround it, has been judged to be one of the most skilful operations in the whole technological world. In the days of the "dam-busters", all instrumentation was analogue: oil pressure, engine revs, height and air speed would all have been represented on dials with needles indicating the current status. But now the flight deck of an aircraft is one of the most highly computerised and automated of environments. The first generation of instruments for such flight decks was extensively (though not exclusively) digital. Air-speed, height, and engine revolutions became numbers on a digital readout. But soon the limitations of such 'readouts' became apparent when pilots – under pressure of time and sometimes in critical circumstances – had to internalise the data and make it *mean* something. Under severe pressure, and in a nanosecond glance, 10,100 can be read wrongly or interpreted badly. In contrast, a scale that shows the range of possible numbers and represents the current status as a point on that scale is not only more comprehensive, but is also more immediately comprehensible. It is data placed within a framework of meaning.

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EDITORIAL

Countless hours have now been devoted – by psychologists, designers and cognitive ergonomists – to evaluating the most appropriate ways of presenting information in this critical flight-deck environment (see for example Ch 5 'Machine-Man Communication Displays' in David Obourne's fascinating book of *Ergonomics at Work: Human Factors in Design & Development.*

So how does all this relate to my lecture at the NEC exhibition? As usual I was banging on about assessment – and at one point I touched specifically on the problems that teachers had encountered when trying to use the assessment schemes that had been dreamed up (or was it a nightmare) for National Curriculum assessment.

In the post-TGAT world, National Curriculum assessment was dominated by Statements of Attainment that were perceived at the time (within SEAC) as free-standing bits of capability. And all one was allowed to say in response to them was YES or NO. This represented a startling change of direction in assessment practice for – prior to the National Curriculum – the vast majority of assessment was on analogue, sliding scales of excellence A-E or 1-10 or 1-100. These gradations of excellent ------ good ------ poor were dispensed with at a stroke. The uncertainty and often the hesitancy of analogue assessment on sliding scales was replaced by the blunt certainties of the digital world. Either she is or she isn't. Either he can or he can't. The vast majority of teachers had never before encountered such a simplistic model of assessment.

Incredibly, this issue never appeared as a matter for debate in any of the National Curriculum documents. Not in TGAT, not in the Technology Order; not in the NCC's 'From Policy to Practice'; nor in their 'Starting out with the National Curriculum'. It is almost as if there was an assumption that the whole of past practice in assessment had been wrong. Sliding scales were history.

And as we all know, it ended in tears. As the assessment sheets got bigger and bigger, and the boxes on them got smaller and smaller, teachers felt an increasing separation of the assessment process (ticking or crossing) from their understanding of the capability of their youngsters. Teachers knew whether a pupil was good or poor – but it became incredibly difficult to relate this sense of quality to all the decontextualised digital boxes. It was extremely unhelpful to be forced into the position of having to say 'yes' or 'no' about pupils. Because for most of the time, the majority of them are in categories that are better described as 'maybe' or 'sometimes' or 'partly'.

Analogue sliding scales allow us to talk about better and worse; to discuss *improvement* with youngsters; to develop a sense of *quality.* This whole tradition of assessment had been cast aside at a stroke without even a serious debate about the perceived advantages of yes/no tick-list assessment. The digital was somehow regarded as superior to the analogue, despite the fact that analogue systems were what teachers had always used. In retrospect it is quite astonishing that this digitisation of assessment was allowed to get to the lunatic point at which it arrived in the early 1990s without being challenged to justify itself. And another product of this digitisation was that the authors of the scheme felt obliged to invent lots of different digits to strive for. In the end, National Curriculum assessment was premised on the idea that in order to improve you had to pick up some extra digits – which meant doing something different and extra. This is seriously mistaken for much of the time all you need to do is to do the *same thing* to a higher level of quality.

I am drawn to the conclusion that analogue systems are pretty useful. They are useful in enabling young children to grasp complex ideas in a simple form in the primary classroom, they are useful in supporting instant judgments by pilots in the high tech environment of the flight deck, and they are useful in enabling teachers to make appropriate and helpful assessments of their pupils. There is a real sense in which analogue systems allow us to get closer to – and represent – the reality of the world. An appropriate bumper sticker might be: 'dump the digital – accentuate the analogue'.