The Cockcroft Report: Time past, time present and time future

Margaret Brown explains

**Time present and time past**
*Are both perhaps present in time future*
*And time future contained in time past…*

**Footfalls echo in the memory**
*Down the passage which we did not take*
*Towards the door we never opened*
*Into the rose-garden.*

Extracts from the first section of Burnt Norton, the first of Four Quartets, by T.S. Eliot

It is more than 30 years since the publication in 1982 of what has come to be known as ‘The Cockcroft Report’. Its full title was ‘Mathematics Counts: Report of the Committee of Inquiry into the Teaching of Mathematics in Schools under the Chairmanship of Dr WH Cockcroft’. This means that it happened before many of the teachers now working in our classrooms were even born. Yet it has continued to influence the teaching of mathematics up to the present.

In September 2014 many teachers will be starting to implement yet another version of the mathematics national curriculum - this will be the fifth for secondary schools, and fourth for primaries. So it seems a good moment to work out what elements of the Report, which pre-dated the first national curriculum by seven years, have survived all these changes into 2014, and whether any will remain into 2015 and beyond. The notion of trying to stand outside time and examine simultaneously the interweaving of these elements across time past, time present and time future, seemed to present a useful way of exploring this question.

It is also perhaps useful for a moment to try to stand outside the world of mathematics education. The narrative of education reform in England in the last 40 years employed by politicians, especially those on the radical right, is of a sequence of failed national attempts to reach what T.S. Eliot characterises as ‘the rose-garden’. Using this metaphor, the countries already in the rose-garden are those achieving high positions in international league tables with students who calculate fluently. The repeated failures in England to find the door to the rose garden are regarded as the result of each government-sponsored expedition in search of it being thwarted by ‘producer capture’; the educationists appointed to navigate the route have always instead pointed the way to the wrong door, the one which leads to the child-friendly wildflower meadows which avoid the rose-thorns but are disorderly and economically unproductive. So perhaps from this perspective we should think of the Cockcroft Committee of Inquiry as being the first and most significant of these expeditions. In this narrative, the politicians believe that they have finally wrested control of the satnav; starting in September 2014, the Gove’ curriculum will finally triumphantly lead us into the rose garden.

**The Cockcroft Committee and its context**

The announcement of a Committee of Inquiry into the Teaching of Mathematics in Schools was made in 1978 by Shirley Williams, then the Labour Government education minister, technically as a response to a proposal by a Parliamentary Expenditure Committee in 1977. But prior to this there had been a number of moves by both Tory and Labour Governments towards achieving greater accountability of the education system, and in particular towards the specification of a national core curriculum. The pressure for a core curriculum was partly as a reaction to a very small number of examples, highlighted by the media, of schools which seemed to have incorporated the hippy freedom of the early 1970s into the classroom.

In mathematics specifically there were also partly justifiable concerns as to whether the ‘modern mathematics’ introduced widely into grammar schools in the 1960s, and then into primary schools and the new comprehensive schools in the 1970s, had been taken to excess.

The first governmental moves towards a core curriculum in fact date back to at least for the early 1960s, well before prime minister James Callaghan’s famous 1976 Ruskin speech, with early examples of ‘producer capture’ being the unwillingness of the newly formed, union-dominated Schools Council to prescribe a core curriculum. Further examples were the alleged high-jacking of the new national achievement surveys (Tests of Attainment in Mathematics in Schools, then the Assessment of Performance Unit) to assess a broad mathematical curriculum, including practical problems, and not just calculation proficiency.

Shirley Williams postponed the issue of central control of the curriculum, at least for a while, by requiring local education authorities to consult with their teachers to come up with their own models. The Mathematics HMI, so as to assist this effort
and not to be side-lined by the Department for Education and Science, in 1977 had contributed some proposed objectives for a core secondary mathematics curriculum, with further details following for primary mathematics in 1979. Within the mathematics education community, the 1960s and early 1970s had been a time of experimentation, not only with ‘modern mathematics’ schemes but also with mixed ability teaching, use of early calculators and computers, investigations, led by the ATM, and practical problem-solving, for example the Schools Council Mathematics for the Majority Continuation Project.

So the Cockcroft Inquiry was mainly required to survey a variety of existing developments in the light of perceived concerns from employers and higher education, and arrive at recommendations which would command consensus across diverse stakeholders and set the framework for future developments, a brief which it fulfilled admirably.

There were two aspects of the Committee of Inquiry which were key to its success (a) the generous time and resource it was given, and (b) its broad and representative membership. This included many key people from the professional mathematics teaching associations. There were a few external stakeholders, but the vast majority of members had current or previous experience of teaching mathematics. Neither of these two factors is remotely imaginable today. First, in the current climate, committees are rarely given longer than six months to report in order to achieve implementation before the next election; the Cockcroft Committee in contrast was set up by a Labour government who seemed relaxed about the fact that it might, and indeed did, report to and be implemented by a Tory one. This was achievable only in a more innocent era when education was not perceived as strongly politicised. Second, the current political suspicion of pro-active teachers and educationists as members of some mythical Marxist ‘Blob’, more interested in socialism than in standards, has led to a view that the only people who can be trusted to make wise recommendations are politicians, unbiased by either insider knowledge or classroom experience, and maybe a few sympathetic and trusted allies.

The selection of Dr W. H. Cockcroft, later Professor Sir Wilfred but always known as Bill, as chair was inspired. A blunt but genial Yorkshireman, and a respected academic mathematician who had become a vice-chancellor, he had previously shown interest in school mathematics, and in particular had with great wisdom chaired the advisory group of the Nuffield Primary Mathematics Project.

It is interesting to note on reading again the list of members, that two then in classroom teaching, Afzhal Ahmed, and the late and much missed Kath Cross went on to take leading roles in the mathematics education community;

An important consequence of having time and resources was that it was possible to investigate popular claims. In his Ruskin speech James Callaghan had cited as a key problem that employers were dissatisfied with standards of numeracy among school leavers. However this didn’t really stand up in the light of the Cockcroft sponsored research, whether because employers could become more selective in a time of rising unemployment, or for other reasons. This was important as it gave the committee more freedom.

The time and resources, and the members, ensured that the Cockcroft Report was much more than a set of recommendations; it was closer to a handbook, both coherent and well-argued using experience and evidence to provide comprehensive guidance for policymakers and practitioners on a wide range of issues relating to mathematics education. I will only deal briefly with three of these: curriculum and teaching styles, differentiation, and local co-ordination and support. All these have been recurring themes up to time present and seem likely to feature in time future.

The mathematics curriculum and necessary elements of teaching

A theme of the whole report was, in contrast to the ‘modern mathematics’ movement of the 1960s and 1970s, to emphasise the usefulness of mathematics and its importance as a common language of communication across diverse areas of application. A further theme following from this was that in order to apply mathematics it was necessary not only to have mastered procedures but also to have a connected understanding of mathematical ideas and practice in solving problems.

As noted, the trend towards a core curriculum was well under way when the Cockcroft Committee was assembled, so there was considerable pressure on it to provide a list of mathematics basics that all children should have mastered by age 16. The clever solution of the Committee, after considerable agonising, was to accept this responsibility (for if they hadn’t someone else would have stepped into the vacuum). However they formulated a Foundation list (Paragraph 458) which built on the breadth of earlier HMI work; the final version steered away from an earlier draft, limited to knowledge of facts and procedures, towards a much wider set of objectives incorporating understanding and application across many areas of mathematics. This formed the heart of the 1988 first mathematics national curriculum, and of its later variations until time present. It also formed the core of GCSE syllabuses for many years, including the current foundation tier.
Reading through the list now, there are therefore few surprises. The major aspect we have lost is an emphasis on practical work e.g. ‘Be able to visualise and understand simple mechanical movement, including the working of simple linkages’. Though interestingly the list did not include much practical work in statistics, an area where the expectations seem from today’s perspective to be lacking ambition. This practical emphasis is of course in line with the most quoted Paragraph 243 which included practical work as one of the six elements of good mathematics teaching, of which more in a moment. The emphasis on the practical and utilitarian also informed the advice in the Foundation List about calculation, which has irritated conservatives in both parties yet survived as a basis of national curricula and national strategies for a generation, until time present.

‘Pupils should possess some reliable method (however unconventional) of carrying out calculations without the use of a calculator when the numbers are small, and with a calculator when larger numbers are involved. There is a need to develop and encourage intuitive methods of both written and mental calculation...Fluency in computation using methods whose basis is understood should be developed by short and frequent spells of practice...

Pupils should be able to perform calculations involving the word ‘of’, such as 1/3 of £4.50,...Be able to add and subtract fractions with denominators 2, 4, 8, or 16 in the context of measurement.’ Para. 458

The Report led to an early increase in practical work which has steadily reduced over time, being a victim as much of the advent of interactive white boards and cuts in equipment budgets as of reduced teacher training periods and the growing influence of right wing attitudes. Interestingly practical work seems to have become, in time present, fashionable in Singapore, a factor which seems to have escaped the politicians who have otherwise sought to use Singapore’s high performance in international surveys as a reason to return our future national curriculum to the non-practical, non-utilitarian, written algorithm-based curriculum which we exported to Singapore in the 1950s, having then abandoned it ourselves as being widely dysfunctional.

Of the remaining five elements of good teaching, teacher exposition and consolidation/practice have, and probably always will, remained a staple diet of mathematics classrooms. Although the Report has something to say about what achieving high quality in these elements means, this seems distinctly underplayed. The remaining three elements, problem-solving, investigation and discussion, received most emphasis but have barely managed to survive to the present, although in different forms and to differing degrees. It would be a complex task to describe the various changes to the elements of the national curriculum and to its assessment which related to these three elements, but for much of the 25 years they were included under the main attainment target heading of Using and applying mathematics within three sub-headings of problem-solving, reasoning and communication. Assessment of the elements fared rather worse. The Cockcroft recommendation that assessment other than by short written examination, and preferably by teachers (Paragraphs 534-5), was needed to assess these three elements was honoured in the coursework element of GCSE, which slowly over time dwindled in scope, and in the innovative pilot Key Stage 1 and Key Stage 3 tests. Both the latter were quickly abandoned by John Major’s Tory government.

And by the time of the 2000 curriculum change, implemented within the detail of the National Strategies, these elements were described as being integrated into the content targets, and were much reduced in scope. At primary level this finally included nothing much more than solving straightforward word problems in everyday contexts, which remains the current situation. The only positive remnant was that the Year 6 national tests (SATS) have always contained at the end a small number of items which required some problem-solving ability.

The situation at secondary level was similar until 2007 when, under the last Labour Government, a new secondary national curriculum was implemented. It was developed under the auspices of the Qualification and Curriculum Development Agency (QCDA) who gave a steer for all subjects to focus on process skills rather than content. The result was much more detailed specification of problem-solving, investigative and communication skills accompanied by a minor attempt at classroom revival driven by the QCDA and encouraged by the pilot of a second mathematics GCSE. However since it had been announced in 2006, ironically just prior to the introduction of the new curriculum, that the remaining minimal coursework element in GCSE originally implemented in 1988 to assess problem-solving and investigation would finally be abandoned in 2009, not all teachers were persuaded it was important to focus on process elements in a time of increased pressure on GCSE results. So, at time present the neglected four elements in mathematics teaching identified by Cockcroft, practical work, problem-solving, investigation and discussion, seem to be scarcely more present in classrooms than they were in 1978.
But, what of time future? It is true that, in the new 2014 national curriculum, problem-solving constitutes one of the three main curricular aims, along with fluency and mathematical reasoning. But in the body of the primary curriculum (45 pages) and in the specimen test items, we are now a long way from Cockcroft. The few vague references to practical materials have disappeared by Year 3 in the long new lists of content-based skills. No calculators are allowed in the new Year 6 tests, indeed this started from 2014. The specimen Key Stage 2 material for Paper 1 in the new tests is worth quoting to see the contrast with the earlier quotation on calculation from Cockcroft:

‘An arithmetic paper. Questions will be context-free. They will assess number, calculations and fractions. ...Pupils will be expected to use formal methods to solve specific arithmetic questions, eg long multiplication and division. There will be clear guidance in the test booklet and the administration guide to indicate when a formal method is required. Two marks will be available for these questions. One mark may be awarded if an appropriate formal method is used but the answer is incorrect. Each question in the arithmetic paper will have a grid area to encourage appropriate working out.’

Key Stage 2 Specimen test materials, July 2014

It is really not clear what this has to do with the digitised world of the 21st century, where you are hard put to it to find pen and paper, let alone squared paper, and getting a right answer matters more than being able to set out calculations neatly using methods developed for efficiency by Victorian clerks.

Papers 2 and 3 are said to cover problem-solving and reasoning, and the specimen questions do include standard word problems and context-free questions which have an element of problem-solving in that they are in a novel format, maybe less novel after a few years and require 2 steps. For example: \(1\frac{1}{2} + 1\frac{1}{4} + x = 1\). Squared paper is provided here too. The broad curriculum remains, but there is little sign of official encouragement for investigation or discussion, though ministers would no doubt suggest that these are part of pedagogy and therefore their inclusion is left to the teacher.

At secondary level the future seems only marginally closer to the Cockcroft spirit in that there is much less specification about procedures, and assessment is largely left to the examination boards. The value of some of the curriculum, either for its usefulness or for its key position in pure mathematics must be in doubt, as again the only rationale for inclusion seems to be whether it is taught in Singapore. Problem-solving, as one of the three aims, does form one of the three assessment objectives, and the pilots for the linked pair of GCSEs, now abandoned, have given examiners some experience of more open questions. But in a content-heavy and demanding curriculum it is not clear yet whether genuinely challenging questions can be incorporated to any real extent in final written examinations without leading to unacceptably low marks.

**Differentiation and graded tests**

Traditionally there was a strong history of differentiation within mathematics in England. We had long had selection at 11+, and most secondary schools and larger primary schools had a system of either setting or streaming. There were GCE O-levels, mainstream CSE exams officially for roughly the 20th to 60th percentile, and either locally-run mode 3 CSE exams or some other system for the lowest 40%. However at the time that the Cockcroft Committee first met there had been a certain amount of challenge to this structural stratification with large numbers of comprehensive schools being created during the 1960s and 1970s and some experiments in mixed ability teaching, although individualised secondary schemes, like SMILE in London, and primary workbooks, focused differentiation on individual pupils rather than classes.

The Cockcroft Report was strongly influenced by the then recently published research by the *Concepts in Secondary Mathematics and Science* (CSMS) project (I have to declare an interest here as I was involved in presenting the results to the Committee). These results demonstrated a wide range of attainment at any one age in relation to the rate of progress from year to year. We knew from this data that a specific question, ‘**what number is one more than 6399?**’, which the median child would master between the ages of 10 and 11, was only successfully answered by a pupil at the 85th percentile at age 14. I remember asserting to the Committee with confidence, but with no evidential basis - though we collected it later, that some 7-year-olds would be able to give the right answer to this question, and so the **‘seven year difference’** (Paragaph 342) was born!

This specific finding and the broad span of CSMS results which demonstrated clearly the shakiness of many secondary children’s understanding of mathematics, informed some recommendations of the Report that there should be greater differentiation of both curriculum and examination syllabuses (Paragraph 473) in order that all pupils should be presented with examination papers that gave them an opportunity to show what they knew (Paragraph 518). This included a recommendation leading onto the three tier mathematics GCSE
(Paragraphs 472, 528), which Bill Cockcroft, who went on to be the first chairman of the Secondary Examinations Council, was in a position to implement.

The more interesting recommendation in some ways was that for the lowest 40% of the attainment range, there was a series of graduated practical tests at different levels to be taken between the ages of 14 and 16, assessed by teachers (Paragraphs 547-548). This built on the fact that graded tests had recently been used very successfully in modern languages to certificate gradual steps in learning throughout secondary schools.

One post-Cockcroft government contract for development was given to the School Mathematics Project (SMP) which later extended graduated tests across the attainment range. A second consortium which from the start wanted a wider form of assessment across the full range and also from 11-16, culminating in a GCSE grade, was that of Graded Assessment in Mathematics (GAIM). This group obtained funding mainly from the Nuffield Foundation and the Inner London Education Authority. Although the Major government’s restriction on teacher assessment prevented both these schemes from developing, it was not before the latter had a strong influence on the levels structure for progression and differentiation chosen for the first national curriculum, which has remained until time present.

Curriculum differentiation started to be eroded by the National Strategies with their uniform year-by-year curriculum. It will be abandoned almost completely by 2016, when levels are removed and a new and challenging, undifferentiated, and highly specified curriculum at primary level will lead towards just a 2-tier curriculum and GCSE at Key Stage 4. Hence the Cockcroft principle of differentiation, allowing each student to succeed at an appropriate level, is now to almost completely disappear, at least officially.

Co-ordination and support

One of the best outcomes of the Cockcroft Report was what was called ‘The Cockcroft missionaries’; these were selected by the mathematics adviser from among the best teachers in each local education authority, with the brief of supporting teachers within that authority to implement the recommendations of the Cockcroft Report. This was not exactly a proposal within the Report, although it did in Paragraphs 737 to 739 urge an expansion of advisers and support the role of advisory teachers. The ‘missionary’ model was highly successful, so much so that it was repeated in 1999 for the implementation of the National Strategies, only by this time there were fewer mathematics advisers around to supervise.

The situation in time present is much less favourable, with local authority support systems having fallen apart as schools become free-standing academies. There are almost no full-time mathematics advisers, except in the very largest academy chains, and certainly no consultants or missionaries.

But there is hope for some improvement in time future, as school-based mathematics hubs start to function. Whether these are sufficiently well-funded, with each hub on average currently supporting 600 other schools, and whether these other schools will all be willing to commit to this model, time will tell.

Time Future

The Cockcroft Committee produced a report that was full of humanity yet not afraid to address the issue that many pupils were not getting the quality of mathematics teaching that they deserved and the nation needed. It made recommendations that were enlightened, well-argued and achievable, and they were almost uniformly welcomed by both the educational community and other stakeholders. The key proposals were implemented by a government of a different party than that which launched it, and it had a significant effect in a wide range of countries. The fact that it has continued to influence what happens in classrooms over more than 30 years is testimony to its quality.

However it seems that in 2014 there has finally been a distinct break with the route laid down by Cockcroft - in the approach to calculation, in the abandonment of practical work, investigation and discussion and the narrowing of problem-solving, in the attitude to differentiation, and in the way co-ordination and support for teachers is provided. Maybe the new path will at last lead us to the rose garden - but I’m not putting any bets on it!

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The so called Gove curriculum was a result of policy decisions made by Michael Gove who was Secretary of State for Education from 2010 until mid 2014.
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