Ten Years of Universal Primary Technology Education in England and Wales – What have we learnt?

RESEARCH

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Abstract

In this paper I will attempt to outline the long and complex history of National Curriculum technology at primary level, celebrating the successes as well as analysing the mistakes. It is, in the words of the chairman of the National Curriculum Council (NCC), a 'lesson for us all' (Graham 1993) and makes salutary reading for any country or state about to embark upon the implementation of its own primary technology curriculum. The story in England and Wales is one of 'free-market curriculum making' in which:

> "...policy for technology education has emerged in an unplanned way by a process of action and reaction, involving initiatives and proposals from a variety of stakeholders..." (Layton 1995, p. 114)

When I started my teaching career at a South London primary school in September 1986, little did I realise that the UK education system was about to plunge into the most turbulent period of fundamental curriculum change in its history. At that point the Thatcher government with its new and ambitious Secretary of State for Education, Kenneth Baker, were beginning to plan a free-market economy for schools with – paradoxically – a highly centralised and controlled National Curriculum. Following the publication of a consultation document the following year (DES/WO 1987) it appeared that this curriculum was to be framed in terms of traditional secondary school subjects – ignoring the work of Her Majesty's Inspectorate (DES 1977) which had endeavoured to reconceptualise the curriculum as 'areas of experience', adding a new one: 'technological experience' to their list in 1985. Following heated debate, technology became an 'academic' subject in its own right within the new curriculum:

> "The one truly revolutionary subject to enter the National Curriculum has been technology. Indeed it would not be an exaggeration to say that it was invented for the curriculum and has gone on to become part of the extended core." (Graham 1993, p. 53)

The 1988 Education Act made England and Wales the first countries in the world to include technology education for all children between the ages of 5 and 16 by law. Kenneth Baker saw it as of greatest importance for the economic well-being of the country, and its introduction was strongly supported by industry and powerful subject interest groups vying for position in the secondary curriculum. The new subject was built upon strong foundations of work already going on in primary and secondary schools, and all seemed set fair for a radical and exciting initiative in curriculum development. Yet by 1992, less than two years after the Statutory Order for Technology had been enacted, grave concerns were being expressed, sufficient for one influential group to claim that, "technology in the National Curriculum is a mess" (Smithers and Robinson 1992, p. 5). In 1999, after five versions of the Order, six Secretaries of State and a change in government, we are about to embark upon yet another revision for the year 2000. The last decade has been a bewildering one for primary teachers, largely excluded from the debates that have raged at secondary level, and some primary schools are actually teaching less technology than they did before the National Curriculum appeared! What has gone wrong?

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Only in 1999, 10 years on from the first draft Order, have we finally established a clear rationale for the nature of the subject and its inclusion in the curriculum (QCA/DfEE 1999), yet there are many other mistakes from which we can learn, such as haste of implementation; lack of real consultation; inadequate provision of training and resources; all of which I will consider. It is first necessary, however, to briefly trace the roots of the subject in the primary curriculum, to understand the nature of the changes which were attempted.

Strands of development leading to the National Curriculum

> "Although the area of educational experience with which we are concerned has roots which extend deeply into the curriculum of many primary and secondary schools, its formulation as a foundation subject in the National Curriculum represents a new departure." (National Curriculum Design and Technology Working Group 1988, p. 1)

There is a tradition in British primary schools stretching back into the last century of children making things with their hands. Various labels have been applied for these activities, from 'cooking', 'sewing' and 'craft' to 'junk modelling', 'primary engineering' and 'practical problem solving' (Ritchie 1995). During the 1980s, influenced by

secondary curriculum initiatives, CDT (craft design technology) and 'primary science and technology' (seen as indistinguishable and covered by one umbrella term) became more popular (ibid.). The Design Council's influential report 'Design and Primary Education' (1987) saw many of these activities as 'design-related', involving the appreciation of the 'made world' and the manipulation of materials to achieve children's design intentions. The emphasis began to shift from 'making' to 'identifying needs', 'imaging' and taking decisions about shape, texture, colour and function. Much of this emphasis can be seen in the early versions of the National Curriculum Order, which emphasised 'process' over 'content' and had as their joint aims the development of technological 'capability' and 'awareness'.

The most powerful influences on the new curriculum were, however, secondary subject associations and related bodies, each of whom sponsored their 'own version' of technology (Layton 1995). They can be roughly categorised under the following headings:

The 'science' lobby

Bodies such as the Association for Science Education (ASE) and Secondary Science Curriculum Review argued for a version of technology which was effectively 'applied' or 'practical' science, drawing from the work of Project Technology (Harrison *et al* 1967–70).

The 'craft' lobby

Under this umbrella can be grouped interests as diverse as traditional woodwork and metalwork, embodied in the Association of Advisers in CDT, and the Crafts Council, all of whom were concerned with the quality of construction and finish, and saw technology as 'well-made products'.

The 'design' lobby

Following the Royal College of Art project 'Design in General Education' (1975), agencies such as British School's Technology, The Design Council and the National Problem Solving Project began to establish an identity for design and technology which was distinct from science and concerned with a version of technology akin to industrial design.

The 'home economics' lobby

Concerned that their subjects were to become marginalised in the new curriculum, teachers of textiles and food technology, under the National Association of Teachers of Home Economics (NATHE) argued for a broad version of technology which included work with their particular materials.

The 'business' and 'vocational' lobbies

I have grouped these together, although their concerns were not identical. The National Association of Advisers and Inspectors for Business and Economic education were, like the home economists, anxious to preserve their place in the curriculum, whereas bodies such as the British Management Data Foundation were keen that 'technology' would prepare young people for industry. This 'industrial trainers' (Williams 1961) rationale for the development of a narrow, vocational version of technology was extremely powerful, and built upon the work of the Technical and Vocational Education Initiative in the 1980s:

> "Throughout the 1980s and prior to the inauguration of the National Curriculum in England and Wales, probably no single influence was more significant in shaping school technology and enhancing its curriculum status than the government's Technical and Vocational Educational Initiative (TVEI)." (Layton 1995, p. 92)

I have omitted two major interest groups – art educators and information technology – because both quickly established their own place in the curriculum, and although contributing to technology, they were of less significant influence than those listed above. I have also left out perhaps the single most influential body in the subsequent changes to the curriculum – the Engineering Council – since its interventions are less easy to categorise. On one hand it published a report supporting problem solving in schools (1985) and lobbied with the Design Council to include the word 'design' in the subject title (Layton 1995), but it also criticised the Order as making insufficient links with science, and most significantly in 1992 condemned secondary school practice as unconcerned with making 'high quality' products. So the Engineering Council can be seen to have shifted freely between interest groups in its, arguably mischievous, attacks upon the architects of the new curriculum.

The development of the first National Curriculum Order

> "...in inventing (technology) as a subject there is little to go on." (Smithers and Robinson 1992, p. 13)

Although the above statement may seem to contradict the content of the previous section it is true that the original construction of the National Curriculum was a step into the unknown. It was decided initially to establish working groups for each subject to develop their proposals autonomously, though this was subsequently admitted as a mistake (Graham

1993) since it led to overload and lack of coherence, particularly at the primary level. At one point it was not proposed to establish a group for technology, but to include it instead as an overarching cross-curricular theme:

> "The original pure and simple concept was that technology should and could permeate all subjects and that it may not have needed any of its own space in the timetable." (op cit. p. 56)

It was soon decided, however, that this would risk marginalising one of the government's central tools for industrial renewal, but nevertheless the groups were set up in an implied hierarchical order in which primary technology was initially the responsibility of the Science Working Group:

> "The Secretaries of State announced on 10 July the establishment of the first two groups, for mathematics and science ... Other groups will be set up as soon as possible ... on technology (to link with the emerging thinking of the group on science)..." (DES/WO 1987, para. 69-70)

> "The remit of the (Science) Group was extended in September 1987 to cover technology as well as science at the primary level." (National Curriculum Science Working Group 1987, p. 1)

Thus at the earliest stage of development, the influence of the 'science lobby' could be felt upon the emergence of primary technology. The Science Group found this part of their brief particularly difficult however, and were soon relieved to hand over responsibility to the newly created Design and Technology Working Group.

> "...we cannot by this means do full justice to technology in the primary school and we recognise a difficulty in meeting our terms of reference in this regard." (*op cit.* p. 40)

> "The group's remit for key stages 1 and 2 (ages 5 to 11) embraced design and information technology only. In July 1988 the group's remit was extended to include advice on attainment targets and programmes of study for primary technology, taking account of the work which the science group had already carried out in this area." (National Curriculum Design and Technology Working Group 1988, preamble).

The chairman (sic) of the new group, Lady Parkes, was advised to link her recommendations closely to the existing work of the Science Group, but since so little progress had been made this guidance was of little help. The new group was already under quite different influences, principally from the 'design education' lobby, which resulted in the inclusion of 'design' in the title for the subject with the following rationale:

> "A point of definition that requires immediate comment concerns the use of the dual term design and technology. Our understanding is that whereas most, but not all, design activities will generally include technology and most technology activities will include design, there is not always total correspondence. Our use of design and technology as a unitary concept, to be spoken in one breath as it were, does not therefore embody redundancy. It is intended to emphasise the intimate connection between the two activities as well as to imply a concept which is broader than either design or technology individually and the whole of which we believe is educationally important." (op cit. p. 2.)

Although the subsequent Statutory Order retained the title 'Technology' to embrace both information technology (IT) and design and technology (D&T), the latter title has been retained for the 'subject' in England and Wales ever since, which has served to give it a character distinct from many other versions around the world. The group's Interim Report (1998) was a truly innovative and visionary document, defining the new subject in grandly philosophical terms:

> "The special characteristic of design and technology (D&T) is that pupils learn the capability to operate effectively and creatively in the made world." (op cit. p. 74)

It was ambitious, setting standards which were 'consciously above existing practice' (Graham 1993) and was widely welcomed and applauded, although predictably each lobby group had something to say about their own status within it. The Design Council felt that the interpretation of design was 'too restrictive' (Layton 1995) whilst science educators worried that insufficient links had been drawn with science. In particular, an over-complex 'Programme of Study' comprising 16 sections was criticised and subsequently reduced for the final version. One of the truly innovative features of the report, which marked it as radically distinct from those of either science or mathematics was that its framework of assessment – the 'Attainment Targets' – were process rather than content based. It is to this process model – which in some ways proved to be the subject's downfall, leading to many subsequent revisions – that we must now turn.

Models of the design and technology process in successive curriculum versions

The Interim Report proposed a five Attainment Target model for design and technology:

> AT1 Explore and investigate contexts for design and technological activities.
>
> AT2 Formulate proposals and choose a design for development.
>
> AT3 Develop the design and plan for the making of an artefact or system.
>
> AT4 Make artefacts or systems.
>
> AT5 Appraise the processes, outcomes and effects of design and technological activities.
>
> (National Curriculum Design and Technology Working Group 1988, p. 78)

By the publication of the Statutory Order (1990) these had been reduced to four:

> AT1 Identifying needs and opportunities.
>
> AT2 Generating a design.
>
> AT3 Planning and making.
>
> AT4 Evaluating.
>
> (DES/WO 1990, p. iii)

One of the initial problems with the model, particularly in primary schools, was that many teachers interpreted them as a set of instructions or prescriptive sequence for project work in design and technology, rather than, as they were intended, "a series of windows into the interactive processes of design and technology through which information useful to teachers about the performance of their pupils can be obtained." (Layton 1991, p. 5) This situation in which teachers were teaching to the assessment framework rather than the Programmes of Study led to a linear, mechanistic design process which came under criticism as unrepresentative of what designers and technologists actually do (APU 1991). However, although the Assessment of Performance Unit (APU) were to have much influence on the way in which teachers made judgements about children's performance, their process model of 'the interaction of hand and eye' (ibid) was not taken up by the Working Group and its successors. Instead, the intervention of the Engineering Council (see below) was to shape the next version of process in the curriculum:

> "Although essentially part of the same process (the Attainment Targets) have become separated and been given equal weight. We believe this does not give sufficient priority to 'planning and making', which since technology is a practical subject should be pre-eminent."
> (Smithers and Robinson 1992, p. 17)

This criticism of stages in the process being seen as 'products' in themselves (research, drawings etc.) can be seen as representing the views of the 'craft' lobby, and found expression in the recommendations of the renamed Department *for* Education later in the same year:

> "The four Attainment Targets in the present Order should be reduced to two:
>
> – Attainment target 1: Designing;
>
> – Attainment target 2: Making.
>
> The Attainment Targets should be weighted for assessment purposes as follows:
>
> – 40% weighting for Attainment Target 1;
>
> 60% weighting for Attainment Target 2."
>
> (DfE 1992, p. 3)

It is this model of 'process', in which designing and making are effectively separated and making given the higher priority, which has dominated the design and technology curriculum over much of the past decade, particularly since the new Statutory Order in 1995. However, change is afoot once more, and the outcome of the current review has proposed that the number of attainment targets be reduced because of concerns over this dualistic model:

> "The two attainment targets have been combined into a single attainment target to reflect the changes in the programmes of study, to simplify assessment and to emphasise the interdependence of designing and making."
> (DfEE/QCA 1999, p. 7)

Ironically, the original Design and Technology Working Group considered adopting a single Attainment Target in 1988 to emphasise the holistic nature of the process, but decided against it, partly because it would be out of step with other subjects and partly because they wanted to provide more guidance to primary teachers unfamiliar with this model of technological activity. The parallels with earlier thinking in the new recommendations do not end here; witness the section dealing with Programmes of Study:

> "The requirements about *designing and making skills and applying knowledge and understanding* have been clarified by conflation into four strands – *developing,*

> *planning and communicating ideas; working with tools, equipment, materials and components; evaluating processes and products; and applying knowledge and understanding* – to reflect the designing and making process."
> (QCA/DfEE 1999, p. 7)

These four strands bear more than passing resemblance to the original four attainment target model in the 1990 Order, showing that at least in some ways we have come full circle in our attempts to define the slippery concept of 'design and technology capability'. This is not to imply that much has not changed on the way – D&T has been subjected to a very 'rough ride' over the past decade, some of which it is instructive to describe.

Criticisms of National Curriculum technology, and its remaking

> "You see, once you put out an approved curriculum, if you have got it wrong, the situation is worse afterwards than it was before." (Margaret Thatcher, interviewed in the *Sunday Telegraph*, 15th April 1990)

This remarkably prescient comment, made during her last few months in office and immediately before the official enactment of the Statutory Order for Technology, shows the misgivings Mrs Thatcher already had about the National Curriculum. Duncan Graham, chairman of the NCC, also worried that they were 'creating a monster' with the uncoordinated work of so many subject groups, each anxious to carve as large a slice of the 'curriculum cake' for themselves as possible. However, since they were reassured that design and technology was not far away from what they were doing already, and only had three other subjects to worry about at that stage (English, Maths and Science) primary teachers were initially optimistic, and early signs appeared to be good. HMI conducted a survey in the spring of that year, and concluded that:

> "…much of what is contained within the National Curriculum requirements is familiar ground to many primary schools."

and that:

> "The skills involved in making things were well taught and most children were offered a wide and suitable range of materials with which to work." (HMI 1991, p. 6)

Things were soon to change. In 1991, Statutory Orders for the other five 'foundation' subjects became law placing huge pressures on primary teachers, and the requirement for secondary departments of CDT, Home Economics, Art and Design, Business Studies and IT (the so called 'famous five') to combine in the delivery of National Curriculum technology created huge organisational problems. The HMI survey for the following year concluded that:

> "…many teachers have found the D&T aspects of the Order unhelpful and difficult to understand." (HMI 1992, p. 9)

Several other criticisms of the quality of work seen were made, leading one national newspaper to report that:

> "The HMI inspectors found that standards were lower in classes using the national curriculum … than in those where it had not been implemented." (*The Sunday Times* 1st June 1992)

Almost simultaneously with the HMI report appeared 'Technology in the National Curriculum – Getting it Right' (Smithers and Robinson 1992), prepared for The Engineering Council but released into the public arena. Although only really addressing secondary schools, its hard-hitting message, loaded with 'soundbites' was widely quoted in the media as condemning the trivialisation of technology to 'Blue Peter' and 'Mickey Mouse' activities with 'Egg Boxes' (*The Sunday Times*, Channel 4). In fact, the main criticism of the Order was its breadth, which had been considered a strength:

> "From being essentially about designing and making it had become generalised problem solving without a specified knowledge base." (Smithers and Robinson 1992, p. 6)

The contribution of several secondary subject groupings to the construction of the order and its implementation was not seen as helpful; ironically considering that the Engineering Council had been one of the pressure groups concerned:

> "The main reason why technology in schools seems so elusive is that it embodies the aspirations of a number of different interest groups which have been kept together only by pitching its objectives and content at such a level of generality that it can include almost anything." (op cit. p. 14)

The report also reflected other criticisms from vocational groups that technology was not preparing pupils for industry. Although drawing upon a small research base, ignoring the primary sector, and open to the charge that its criticisms were "less than disinterested." (Graham 1993) the report indirectly led to the establishment of an 'inquiry' under the newly privatised school inspection service, the Office for Standards in Education (OFSTED).

The results of this inquiry, when published, effectively became the new draft Order for Technology (1992), which asserted that:

> "Design and technology involves applying knowledge and skills when designing and making good quality products fit for their intended purpose." (DfE/WO 1992, p. 13)

Consultation immediately began on the new proposals, but was soon overtaken by events when the new Secretary of State, John Patten, announced a review of the entire National Curriculum (1993) which was beginning to disintegrate under the unwieldy demands of too much content and an overwhelming assessment burden. Sir Ron Dearing was appointed to head the review, which involved the production of a draft Order for design and technology (1994) – IT having been 'uncoupled' from technology – before the final (and current) Order was produced in 1995, with the stipulation that there was to be a five year 'moratorium' on curriculum change.

Before this period was half way through, there was a change of government and a shift of emphasis in the curriculum towards the 'core skills' of literacy and numeracy, leading to a point in January 1998 when the current Secretary of State, David Blunket, allowed primary schools to 'disapply' the Programmes of Study from the foundation subjects, including design and technology. This was to prepare the way for the National Literacy (1998) and Numeracy (1999) Strategies, which have effectively relegated design and technology to an 'afternoon' subject with minimal curriculum time and low priority. Hence it is true to say that many primary schools in England are currently teaching less design and technology than a decade ago. The picture is not one of universal gloom however, since successive OFSTED annual reviews have pointed to the steady improvement of provision for design and technology, and with the publication of an exemplar scheme of work (QCA/DfEE/DATA 1999) and the proposals for curriculum 2000 there is at least scope for children to reach high levels of design and technology capability. There have been calls for a 'new balance' in education which emphasises the creative skills children need to operate effectively in the world, a concern close to the hearts of the original Working Group:

> "If we are to prepare successfully for the twenty-first century we will have to do more than just improve literacy and numeracy skills. We need a broad, flexible and motivating education that recognises the different talents of all children and delivers excellence for everyone." (NACCCE 1999, p. 6)

Although there are small signs that the tide is turning, it may be too late for primary design and technology in England – buffeted by all the contrary curriculum winds of the past decade and at risk of extinction unless we learn from the lessons this story teaches us.

Emerging themes and lessons

I have drawn below what I believe to be the principle guidelines for implementing a new technology curriculum in primary schools, based upon the experience of England and Wales. Some of these points apply generally to any curriculum development, others are of particular relevance to this unique, yet highly contested subject.

Be clear about your purposes

The National Curriculum for design and technology was not given an explicit rationale until 10 years after its inception: this is clearly rather late. It had an *implicit* rationale, that of training for industry, but this was always at odds with the details of the Order, resulting in confusion and dissatisfaction on the part of all interested groups. You need to be clear about whether technology will be a subject or cross-curricular area of experience in your curriculum, and make explicit the relationship between process and content. It may take some time for competing subject lobbies to arrive at a shared rationale, but this is a debate well worth having before implementation, rather than afterwards!

Define your terms

One of the main problems experienced by primary teachers was unfamiliarity with terms such as 'technology' and 'design' – the wide variety of definitions held by different lobby groups did not help in this regard. A particular difficulty arising from the legacy of 'science and technology' activities in the 1980s has been confusion between the purposes and procedures of science and D&T (Ritchie 1995), subjects which have much in common but distinct identities:

> "As opposed to scientists, who are concerned to explore and understand what is, designers and technologists are concerned with what might be, the conception and realisation of 'the form of things unknown'. (National Curriculum Design and Technology Working Group 1988, p. 4)

On the other hand, successive versions of the curriculum have been reticent to make explicit the links between science and design and technology:

> "There were concerns that the science links were mainly through physics and that the relationship between science

> attainment target 1 (Exploration of Science) and technology needed amplification." (NCC 1989, para. 2.25)

The exemplar scheme of work (QCA/DfEE/DATA 1999) has made these links explicit, but in the meantime much opportunity for effective integrated work has been lost, and where teachers have attempted to teach science and design and technology together, design and technology has often been the 'poor relation' (Ritchie 1995) or seen as merely 'applied science'. This is still an issue which needs further support in schools.

Prepare your workforce

Early in the process of developing the technology Order, the National Curriculum Council signalled the need for:

> "...a major in-service training and initial teacher training initiative – particularly to develop the knowledge and skills of primary teachers..." (NCC 1989, para. 12.20)

At the time this appeared to be achievable within current resources, since the appointment of advisory teachers by most local education authorities (LEAs) had resulted in the provision of a good range of in-service training (INSET) as highlighted by HMI:

> "As a result of INSET there was increasing confidence among teachers, sufficient for most to attempt some work in technology." (HMI 1991, p. 6)

However, this was a point at which the government's education initiatives appeared to work against each other. As part of the establishment of a 'free-market' in schooling, power and funds were removed from LEAs, with the result that:

> "...at a time when teachers need advice and support with the introduction of technology many LEAs have reduced the number of advisory teachers, and closed specialist technology INSET centres..." (HMI 1992, p. 9)

The greater demands imposed by the Order also meant that "...the D&T work of pupils in many schools was constrained by the teachers' limited technological capability." (*op cit.* p. 10) As time went on primary teachers were also coming to terms with the requirements of several other subject Orders, such that few really became familiar with the detail of the Programmes of Study and some had never read them (Anning 1992). The new technical vocabulary was in many cases alien to their 'largely arts-based' culture and concerns (*ibid.*) which in some cases undermined confidence in teachers who had previously been happy with the subject. Anxieties were expressed about health and safety, when to intervene in children's work, and how to set progressively more challenging tasks (Layton 1995). Cuts in school funding were also depriving teachers of the resources needed to improve:

> "In about half of the schools there was insufficient D&T equipment, and few had a satisfactory range of materials..." (OFSTED 1993, p. 3)

By the time of the Dearing review of the National Curriculum, many primary teachers were so overwhelmed that they welcomed any reduction of their workload (*ibid.*) and failed to appreciate the fundamental shift in approach which the new Order (1995) heralded. By this time there was very little INSET available, so teachers struggled on as best they could to make sense of the documentation. Only with the introduction of National Literacy and Numeracy Strategies has coordinated national training taken place. The same provision for design and technology would have made a great deal of difference.

Take time to implement

The successive Orders for technology in the National Curriculum have always been implemented in the classroom within a few months of publication, following periods of 'consultation' of no more than a few weeks, during which teachers did not feel that their concerns were being listened to. The whole process was driven by a political, rather than educational, agenda. Real educational change takes time to 'soak into' the culture of schools, and the pace of implementation over the last decade has not allowed teachers to fully assimilate one version of the curriculum before the next is upon them, resulting in an atmosphere of fatalism and superficial compliance in many primary staff rooms. Very early in the process, HMI observed that "...teachers have had insufficient time to plan teaching approaches..." (HMI 1991, p. 9) yet this warning has not been heeded; even the current proposals are due to be implemented less than a year after publication.

Avoid complexity and explain requirements clearly!

One of the principle changes demanded of primary teachers in moving from traditional 'craft' activities to National Curriculum technology was the requirement for children to 'identify the needs' of prospective users of the products they were to design. To counter some of the arguments that young children were, in Piaget's phrase, too 'egocentric' in their developmental immaturity to identify

with the needs of others, the Working Group decided to set this activity within contexts which they hoped would be familiar and meaningful:

> "Needs and opportunities are identified within contexts…
>
> • home
> • school
> • recreation
> • community
> • business and industry.
>
> …It is recommended that pupils should begin by working in familiar contexts and progress to less familiar ones … The investigation of needs and opportunities is central to design and technology."
> (NCC 1990, para. 2.2–2.4).

However, although this contextualisation may have helped children, it still left many primary teachers anxious about the open-ended nature of the designing and making process, whereas before they had been able to specify the outcome and its demands with some degree of confidence:

> "AT1 necessitated 'problem construction', an activity which was new for many pupils and often their teachers."
> (Layton 1995, p. 103)

The danger of lack of clarity in specifying how teachers were to help children 'construct problems' was a view that 'anything goes' and the erosion of quality in those elements of the process – namely making – with which teachers felt confident. Further confusion was created by the requirement that children were not only to make 'things' (artefacts) but 'systems' and 'environments' as well. Clearly the primary teaching force were not ready for these subtle distinctions in outcomes, inserted through pressure from electronic engineers and architects respectively. The Working Group produced the following diagram to try and clarify what was meant by these terms and their interrelationship:

The lack of exemplar material and other factors mentioned above meant that this complex, though visionary, element of the curriculum was not to survive the first review, despite calls from the profession to retain them:

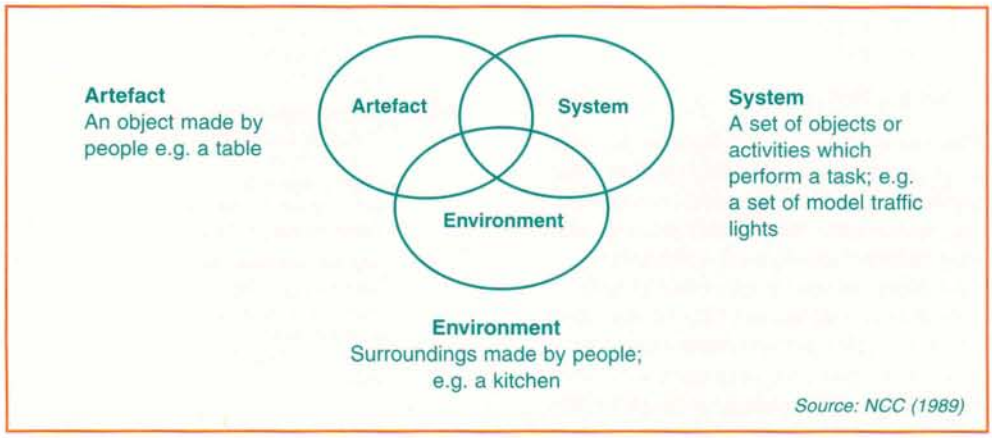
> "We propose that the present requirement for pupils to make three different types of products, in five different contexts, using at least five different materials, at each key stage, should be removed."
> (DfE/WO 1992, p. 5)

This second version also reduced the number of Statements of Attainment from 117 to 59, and introduced 'Design and Make Tasks' (DMTs) through which the majority of the curriculum was to be delivered – a more traditional mode of operation with which teachers were more familiar. By the publication of the 1995 Order these had become three interrelated types of practical activity:

> "The Order sets out three essential types of activity for pupils:
>
> 1. designing and making assignments
> 2. focused practical tasks
> 3. investigating, disassembling and evaluating simple products."
>
> (SCAA 1995, p. 5)

This model has proved relatively successful and is exemplified well in the 1999 exemplar scheme of work. It also seems likely to survive the latest review, although the requirement to 'disassemble' products in primary schools is likely to be removed, presumably because children and their teachers have had problems putting them back together again!

One final problem which bedevilled all of the National Curriculum Orders, was the relationship between Programmes of Study (what was to be taught) and Attainment



Targets (what was to be assessed). The confusing layout of early documents, with Attainment Targets placed at the front and seemingly unrelated Programmes of Study tacked on as an appendix meant that many teachers planned work from the former, a classic case of 'teaching to the test'. Only in later revisions was this problem identified:

> "…the consultation process signalled the need for the proposed Order to … clarify the relationship between the statements of attainment and the programmes of study." (DfE/WO 1992, p. 5)

The complexity of the original Programmes of Study was also a disincentive to teaching from them, a point which successive review processes attempted to address:

> "We propose a programme of study of seven sections covering: Designing, Making, Construction materials and components, Control systems and energy, Structures, Food and Business and industrial practices. We believe this is a helpful and realistic compromise that marks the middle ground between the complexity of the 16 headings proposed in the Final Report of the National Curriculum Design and Technology Working Group and the generality of four in the existing Order." (*op cit.* p. 7)

The 1995 Order continued the process of juggling with pieces of content to assemble them into some kind of coherent structure, though the curriculum had by this time become so 'thin' that the lack of detail was problematic until publication of a National Scheme of Work:

> "Within the section on knowledge and understanding, subsections have been identified which deal with:
>
> materials and components
> mechanisms and control
> structures
> products and applications
> quality
> health and safety
> vocabulary."
>
> (SCAA 1995, p. 5)

This was not, however, the final version since it is currently being reshuffled for 2000. The problem with a 'process model' seems to be that, having taken the difficult decisions about what 'content' should be in a technology curriculum, we end up with a bewildering collection of 'odd pieces of knowledge' from which it is difficult to assemble a coherent programme. The issue of progression within process and content remains difficult because of the comparative paucity of educational research in this area – we still do not have a clear picture of how children learn in design and technology. After several seemingly random rearrangements it becomes increasingly difficult for teachers to remember which version they are implementing. A better approach might have been to decide on the 'absolute minimum' basic core of technological concepts and skills to introduce first, and allow this to take root in classrooms before introducing many of the – highly desirable – 'added extras' which make up a rounded technology education.

In conclusion the last 10 years have certainly been a 'steep learning curve' in the processes and pitfalls of introducing the world's first universal technology curriculum. Despite the many false starts, much wasted paper and time, we are now closer to deciding as a society and profession what we want children to be able to do in the development of technological capability. In the meantime many other countries have followed in our footsteps and hopefully learned from our mistakes. Let us hope, with the current 'squeezing' of design and technology in the primary curriculum for England, that all this effort has not been in vain!

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Appendix: Timeline of Significant Events

1987 Publication of Design Education in the Primary School
The National Curriculum 5–16 – a consultation document
NCC Science working group established with brief for primary D&T.

1988 Design and Technology working group takes over brief for primary D&T
D&T working group interim report.

1989 *Technology for ages 5 to 16*, Proposals of the Secretaries of State
Technology 5–16 in the National Curriculum, NCC report on consultation.

1990 *Technology in the National Curriculum*, Statutory Order, DES and Welsh Office
Non-Statutory Guidance, Design and Technology Capability, NCC
APU report – *The Assessment of Performance in Design and Technology.*

1991 HM Inspectorate report on the first year of Technology, 1990–91
Aspects of National Curriculum Design and Technology, paper commissioned by NCC from David Layton to defend the Order.

1992 Engineering Council publish *Technology in the National Curriculum*
NCC advice to the Secretary of State – *National Curriculum Technology: the case for revising the Order*
OFSTED commissioned to carry out a review
National tests (SATs) for D&T introduced for 7 year-olds
Technology for ages 5 to 16 (1992), Proposals of the Secretaries of State.

1993 NCC publish report on the consultation on the 1992 proposals
Sir Ron Dearing appointed to carry out a review of whole National Curriculum
NCC new proposals for Technology – optional for period 1994–5.

1994 *Design and Technology in the National Curriculum – Draft Proposals* (SCAA)

1995 *Design and Technology in the National Curriculum* DFE/WO
SCAA publish *Design and Technology – the new requirements*
No change for 5 years!

1997 Change of government
National Curriculum review procedure begins again under QCA.

1998 Secretary of State announces that National Curriculum Orders for 'foundation subjects' are to be made non-statutory.
National Literacy Strategy introduced
Maintaining breadth and balance at Key Stages 1 and 2, QCA.

1999 *The review of the national curriculum in England – Secretary of State's Proposals*
National Numeracy Strategy introduce

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