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REPOSITORY RECORD

Nicholson, B.S.. 2019. "Implementing Design and Technology in the National Curriculum". figshare.
<https://hdl.handle.net/2134/1649>.

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IMPLEMENTING DESIGN AND TECHNOLOGY IN THE NATIONAL CURRICULUM

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Introduction

1. This paper arises from perspectives generated when the author held the post of Staff Inspector for Design and Technology, ILEA; as a CDT teacher during the summer term 1990 and in contemplation of the challenge posed for teacher educators in preparing new teachers to deliver D&T.

Close involvement in preparing responses to the various stages of consultation towards the Order for D&T, often in consultation with advisers from all over England and Wales and many years involvement in the generation of new forms of assessment for CDT and now D&T provide perspectives that can help to supplement some of the more helpful documents already available to teachers on the subject of implementation, particularly the Non-statutory guidance for NCC (NSG) (1) and "The National curriculum: Planning for technological Experience" (2)

It is argued here that the sheer quantity of information expressed in the Order for D&T will oppress many teachers who will find it difficult to believe that it can all be delivered, if the creative, holistic nature of open-ended project work is to continue to be the main medium of education in this part of the curriculum. Furthermore, there is the risk that the NSG, with its emphasis on the programmes of study (PoS) will take away from the need to see the Attainment Targets (ATs) as the key to developing technological *capability*.

Again, it is argued that, in the medium term, teachers will find that the challenge of assessing children's attainment in a way that can output levels for reporting will be quite as demanding a challenge as the teaching itself, and therefore that, although the task of explaining the needs of the future has been divided between two separate quangos (NCC and SEAC), the *teacher* will need to bring these two aspects of the work into daily conjunction.

The essence of this paper, then, is that a) the delivery in secondary schools needs to start with seeing the Order for D&T expressed as a matrix with the ATs and PoS set at right angles to each other; and b) that from the outset, planning needs to take into account the assessment process, without allowing the whole affair to become assessment-driven.

A Matrix Approach

2. The **matrix** idea is premised on the notion that the PoS are really knowledge resources intended to inform the activity of technological capability, following the ATs. There is little real possibility of teachers delivering the whole of the order as intended, if *capability* is the goal, and the risk is that the inevitable choice will result in different schools delivering either very high quality versions, or cheapened versions that call upon the lowest common multiple of the examples offered, some of which remain quite trivial, whilst of course they are not themselves statutory. It is salutary to contemplate that this diversity will imply a movement *away from*, rather than *towards* a National curriculum: such a result is not applauded here, but argued to be inevitable.

So the suggestion is that the contributing departments would construct a matrix as outlined above, and then inspect the many **cells** where ATs and PoS intersect, so as to evolve a mapping that they feel confident to deliver. The designing and making process would call upon several or many cells so identified, but the idea would help with planning and then tracking what had been attempted, and probably achieved by many pupils.

In doing this, teachers will need to bear in mind the considerable challenge implied by mixed ability teaching connected with the fact that any age group will be attacking several level targets concurrently

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within the teaching group. The SoAs describe the range of attainments to be expected. This represents in itself a marked challenge, but it is inherent in the National Curriculum that age and attainment should be unlinked, as indeed they have been for years in good CDT teaching, where group sizes of twenty maximum have permitted able teachers to encourage pupils in the group to work at quite different conceptual levels.

The use of a Matrix would not militate against the *five Contexts* set out in the Order, nor would they invalidate the notion of *themes* in the primary schools or "*scenarios*" set up in secondary schools to offer a unifying set of ideas for a piece of collaborative work. The intention would be to make that work manageable, achieve some measure of how well the ground was going to be covered and ensure that it might lead towards something that could be assessed. One of the great paradoxes to be faced is that whilst D&T has to be about an open-ended experience for children, teachers need to offer a structure that will ensure continuity, as complete cover as can be managed and variety of experience. Structured open-endedness may seem like a joke: however it is a challenge to be met in this context.

Assessment

3. Work with the development of Graded Assessment in CDT (3) showed that carefully planned assessment tools can help to ensure progression in pupils' work, and that once sound planning has been done, much of the challenge of assessment has been met. This is not to imply that, although the course has planned structure, there is not the vital freedom for children to be creative in their designing and making activity. The major difficulty will prove to be the need to carry out assessment in the presence of the children, for it is an *activity* we need to assess, furthermore, quite often a group activity, not just an artefact or system, but also that all this often has to take place in a potentially dangerous situation for the unwary where the teacher needs to be supervising all the time, albeit concentrating too on a complex assessment procedure.

Teaching of Basic Techniques

4. Some of those currently offering advice on implementing D&T suggest that children can acquire skills and knowledge on a need-to know basis at the time the opportunity arises. Whilst casting doubt on this dictum should not lead us to the opposite and equally wrong conclusion that children need first of all a craft course, followed by a design course and so on, there will be times when organisational realities imply that some planned teaching will need to take place before individuals necessarily require a skill or piece of knowledge for the pursuit of their own piece of open-ended work.

This in turn implies that not all of the time need we, can we, be operating over all four (five including IT) of the ATs. Some of the time, we need to attenuate the process and make, or design, or design and make, or appraise someone else's design.

Teacher Pupils Ratios

5. Many of the assertions already made suggest that group size is a vital factor in this discussion. Indeed, it is likely to prove a matter of contention in some schools. Some subjects which will probably contribute to D&T have traditionally been taught in group sizes of twenty maximum. Where circus arrangements are in vogue (although the NSG rightly casts doubt on this arrangement) there tends to be the assumption that all groups need to be of the same size as they rotate around the curriculum. This tends to imply a very high teacher-period cost to deliver to the whole year group; a cost that will often mean that not too many expensive periods can be assigned to D&T. One helpful suggestion being operated in some schools is for certain of the contributing areas to share an extra teacher so as to bring down the group size for some of the subject work areas.

Available Time

6. Time constraints represent the root of any real conflict there will be about the delivery of D&T. It was the Secretary of State who suggested the 10% of curriculum time guideline for Design and Technology, as well as the need to broaden the context and knowledge basis to call upon Art, Business studies, CDT, Home Economics and IT. (4) All participants from these subjects were chary of rocking the boat

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too hard, since some other subjects seemed not to be getting a mention at all in terms of having a future. Yet all knew that delivery within 10% to reflect anything approaching the potential of all these subject areas towards Design and Technological capability was simply not feasible.

Knowledge and Design Capability

A particular and interesting paradox here is revealed if we compare this intention with the view cogently expressed by Professor Layton et.al. in "The TVEI Curriculum 14-16" (5) that the knowledge resources for technological project work are immense. The writers of this valuable report suggest that knowledge to support D&T can be roughly divided into two categories; codified, "propositional knowledge", of a kind that might often be drawn from science, and "operational knowledge", about how things are done, often to be acquired in a practical context. The time required to obtain such widely defined knowledge resources as we find in the PoS for D&T provides the nub of the difficulty: it has now to inform projects that are far more diverse than the researchers from Leeds were looking at in their 1987 TVEI study. Also of interest and relevance to the current debate is their analysis of teaching styles (6) as on a continuum between closed-framed-negotiated, the inference being that either the framed or negotiated styles were to be preferred for teaching D&T.

7. The inter-relationship of epistemology and logistics will be at the centre of the implementation debate. Federal versus integrated approaches are discussed in the non-statutory guidance, with a warning about the former and applause for the latter. But to be of much help, deeper debate is needed. Helpful here at the theoretical level is the work of Basil Bernstein "On the classification and framing of Educational Knowledge" (7) where he differentiates between *collection* of discrete bounded kinds of knowledge and integrated approaches, suggesting that "classification" is about the categorisation of knowledge whilst "framing" is to do with the "degree of control teacher and pupil possess over the selection, organisation and pacing of the knowledge transmitted and received in the pedagogical relationship." Whether knowledge and capability are to be separated or, for D&T inevitably inter-twined is dealt with helpfully in the Interim report from Lady Parkes' Working Group. (8)

I suggest that the implication of all this for the implementation of Design and Technology in the National Curriculum is that teachers will have to retain control of the framing process in order to ensure delivery of the ATs *and* of as much of the PoS as will be feasible. At the risk of being accused of contriving situations to some extent, planned open-endedness will have to rule. Those who advise lead lessons and then unconstrained designing and making, with inputs on demand by children will discover this to be a recipe for chaos. Just how much of the PoS will prove to be deliverable will vary widely from school to school, determined by a wide range of educational and cultural factors, In the secondary schools, delivery will of course be affected by the quality and homogeneity of the primary practice which precedes and nurtures it.

Practical help comes to teachers in the form of a debate about depths of mesh, if a mechanical engineering analogy can be permitted. It is not really true that a federated approach cannot deliver, nor that arrangements claimed to be integrative necessarily deliver: we need to look at just what goes on. Many so-called integrated Humanities schemes now litter educational history to show that just good intentions are not enough: little appears in the national curriculum now on the subject of integrated Humanities; rather History and Geography seem to hold sway, with Economics needing to be a combined subject with some other.

At the shallowest depth of mesh, various contributing subjects to D&T will simply become aware of each others' syllabuses, so as to try to avoid wasteful overlap and provide positive re-inforcement. At the tightest form of mesh, subject boundaries will disappear, with all teachers polymath professionals, equally able to inform, enthuse and generate capability across the vast area covered by the ATs and PoS.

Clearly, somewhere between these two extremes is likely to prove the case in most schools: the establishment of a "Matrix" as an aid to mapping contributions is argued to be a good way to start. The overload of PoS coverage will need to be dealt with by being selective, using ability on the part of the staff available to provide real stimulus. But at the same time, an analysis of just *how much* could not be delivered will necessitate some clear planning of in-service training needs, and in the more painful

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cases, needs to introduce additional teachers, even where this will imply some currently available colleagues needing to re-think their careers. Not attractive in the context of LMS.

The Teaching Team

Are polymath teachers the optimum target of initial and indeed, in-service training for the next few years? It is argued that this would not be feasible, if we are to avoid a lowest-common-multiple approach. Real expertise in terms of skills and knowledge will be the best formula not only to enable the imparting of knowledge, but even more challenging, the ability to stimulate really creative activity and capability in the Design and Technological field. The teaching team is the target.

Some Other Issues of Teaching and Learning

8. Should assessment be context-free? In other words, is it possible and desirable to assess the outcomes (process rather than just product) of Design and Technological capability in terms of the attainment targets, without recourse to the programmes of study? Were this feasible, it would certainly be simpler, and take a good deal of the challenge out of the whole vexed and difficult business of assessment. But without reference to the PoS, why should not an able teacher of Motor Vehicle Studies claim to be able to deliver D&T? Why not an able teacher of Rural Studies? Such teachers existed, in the experience of the writer, who were able to be creative, and did in fact address the four ATs set out for D&T. But would that comply with the Order?

9. All versions of the reports leading to the Order for Technology stressed, rightly, the need for assessment to respect and not disturb the essential nature of Design and Technological capability. But this leaves us with several interesting and challenging further problems. The standard assessment task will, in respecting activity as above, and given the time-consuming nature of children's designing and making, need to be an affair that will inevitably occupy most of the available timetable time during the last term of Key stage four, the final term of year 11. Given that the SAT will be intended to be a formative and educational experience in its own right, it will modify children's stage of development. So *a priori*, it will demonstrate for most children that the final *teacher* assessment for work in the preceding term was set too low.

10. In many local education authorities, the presence of children who have yet to acquire English at a fully operational level will constitute a tremendous challenge, particularly if we are to take seriously the idea of negotiated assessment. And as we recognise that it is the design process that a child will have gone through that is at the heart of the ATs, discussion will be inevitably vital.

It is not enough for children to have acquired the kind of everyday, survival English, comparable only with the kind of capability in French that sustains the occasional foreign holidays of many of us; the child will need to have gained something approaching mastery of technical and technological lexis and concepts, a very different business. Holiday makers might care to consider how well we should do in sustaining a *professional discussion* in a foreign language, rather than just having to book a camp-site! And as many London teachers will testify, when they use the in-jargon "E3L" as well as the more familiar E2L, some children come from homes where even their Heritage language has no written form, so they have to make *two* transitions.

GCSE and Key Stage 4

11. At the time of writing this paper, and I fear even by the time of delivery, although children will have reached Y7 who will be the first compulsory *reported* examinees for D&T in the National curriculum, we still do not have guidance on the nature of the interface between GCSE and KS4. Shall we see a 5% entitlement with optional bolt-ons of an endorsement kind to establish GCSE, majoring in one of the contributing subjects? Shall we see just a fully integrated Design and Technology GCSE, and if so, what of the necessary lead-time for the vital in-service training to provide a five-year course that has already started? Shall we have to rely upon combined subjects of the kind outlined by the Secretary of State,(9) for instance "Design and Technology / Electronics, "Design and Technology / Fashion"?

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Conclusion

12. Among these many challenges, it might be concluded that whatever befalls us, boredom will not be a major problem. The fact that Design and Technological Capability has earned a place in the National curriculum based upon so much valuable practice in so many schools over the years will carry us forward, even with the newer challenge to broaden the context and the knowledge base. GCSE was introduced as successfully as it was only given the professional concern on the part of the vast majority of teachers for the well-being of their pupils. That seems to be our best reason for hope.

13. References

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4. Remit to Working group on Design and Technology in the National Curriculum and reprinted in the Interim and Final reports.
5. "The TVEI Curriculum 14-16" University of Leeds 1987 esp. pp. 47-51.
6. *ibid.* pp.24-31
7. Bernstein, Basil. "On the Classification and Framing of Educational Knowledge" in "Knowledge and Control", ed. Young M.F.D.1971
8. Interim Report from Working group on Design and Technology paras. 1.9-1.12.
9. Speech by Rt. Hon. John McGregor, Sec. of State for Education, 25th January 1990

14. Acknowledgements

Many of the perspectives outlined above were developed through having the privilege of chairing a cross-curricular group of ILEA Inspectors who produced a discussion paper to assist teachers through the earlier discussions about N.C. D&T.

Membership of a group of CDT Advisers charged with responding to the various stages of the consultation on D&T and in particular discussions with Bob Welch, Hon. Secretary of AACDT were most valuable as was prolonged discussion with John Whatley, Chair of the London Group of AACDT and also of the D&T Subject Committee for LEAG.

However, I am happy to take personal responsibility for the views expressed, some of which may be controversial.