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APU: DESIGN AND TECHNOLOGY Preliminary findings from the survey data

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Introduction

At the DATER 88 Conference, I described the development of the APU programme in Design and Technology. This involved the creation of the assessment framework, the evolution of the assessment instruments, the operation of the pilot survey, the preparations for the major survey in November 1988 and the strategies we were developing for marking and analysing the responses of pupils.

I can now report that the main survey ran smoothly and involved something in excess of 10,000 15 year old pupils in approximately 700 schools in England, Wales and Northern Ireland. Moreover, the work has now been marked by a team of 88 markers based in four regional centres, and their work has all been cross checked and standardised for analysis purposes. From July 1989 we were able to start building the biggest performance data-base in Design and Technology anywhere in the world and during August we were at last able to start interrogating it. Our overriding concern is that by the time we submit our formal report of the project in August 1990, we should have a much clearer picture of capability in Design and Technology and about the influences that fashion this capability in young people.

As a first step in this direction, my presentation this year to DATER 89 is not intended to be a description of our work so much as an analysis of the principal issues with which we have been grappling in terms of test development and response assessment and with which we are about to begin grappling in terms of data analysis.

ISSUES IN TEST DEVELOPMENT

The issue at the forefront of our minds in test development has been the relationship between the model we developed to describe the nature of design and technology and the model of assessment that this implies. Our model was first outlined in "Design and Technological Activity, A framework for assessment." HMSO 1987. In it we described design and technology as a purposeful, task-centred activity, predicated on the interaction of cerebral activity with practical activity (see fig 1). The iterative mind/hand relationship is the basis of the imaging and modelling activity which is at the heart of capability in design and technology. Given this view of the activity, we were inevitably to characterise knowledge and skills as resources for action - to be used selectively as demanded by the task - rather than as ends in themselves.

This description of design and technology demanded an activity-centred view of assessment, where the focus is on what pupils can do with their knowledge and skills, rather than simply what they hold as knowledge and skills, and this raises the issue of time. We recognised that most design and technology in schools is built (sometimes exclusively) around long term project activity and the question is whether any assessment that is not based exclusively on such long term commitment can ever provide true measures of capability.

Whilst I have always been suspicious of 'examinations' in design and technology, I have equally been unhappy with the idea that the only valid expression of design and technology should be full scale designing, making and testing. Such a view too often leaves pupils having to cope with an endlessly repetitive succession of projects the only differences being in the details of the task or the context or (frequently) the constraints surrounding a solution - "...this time the project will be in plastic (or membrane switches or .. or...)".

The problem with this particular approach is that pupils, whilst being allowed/required to concentrate on particular areas of knowledge, are expected to be able to display ALL of the procedural skills of design and technology in EVERY project. For learning purposes it is somehow acceptable to be selective

about the introduction of materials or energy systems or aesthetic principles, but not similarly thought acceptable to be selective in introducing eg. investigation or evaluation. This is increasingly odd when one reflects that the very nature of design and technology is procedural rather than conceptual and this would suggest that there is a better case for being selective in the introduction of procedures than of concepts. In fact what too often happens is that the procedural complexities of design and technology are such that, in having to cover everything in every project, pupils are forced into unnecessarily superficial work simply to get through it.

In exploring this issue, we became increasingly convinced that it was not only possible, but also necessary to find alternative - and selective - approaches to activity in design and technology. By developing activities that focus on particular combinations of procedural capability, one is not distorting the nature of design and technology but rather helping pupils to come to terms with its complexity. It is however, a very subtle exercise that involves the construction of genuinely 'whole activities' whilst allowing the focus of the activity to be on one or more of its procedural components.

The construction of these focused activities involved us (over a three year period) in the development of contexts and the use of video to project them, the use of team as well as individual activity, and the development of activity booklets that guided and supported the procedural development of the activity. The cornerstone of our thinking has been that having analysed the procedural constituents of design and technology, it is then possible to pick and mix them into an almost unlimited variety of combinations to provide a breadth and variety of design and technological activity. These activities whilst being developed primarily for assessment purposes have proved themselves - through numerous trials and inset exercises - to have equally powerful learning potential for pupils. I would hope that, whilst the data from our survey will be important in reconstructing National Curriculum design and technology, the strategies we have employed will be the more lasting memorial to our work.

ISSUES IN THE ASSESSMENT OF PUPIL RESPONSES

The question that lies at the heart of assessment is what its for, and in the context of an APU survey there are broadly three possibilities. Are we attempting to describe pupil capability in terms of performance grades; are we attempting to explore pupil capability to see what it comprises, or are we attempting to explain pupil capability in terms for example of ability or gender or curriculum background? Each purpose requires a different strategy and different data sets but they remain interdependent and located on a continuum that has broad, holistic, performance judgements at one end and minutely fine performance and background data at the other. (see fig. 2)

We have developed a system of marking work at three levels. Initially any test response is subjected to an holistic judgement to value the pupils work on a 6 point scale. This is then supplemented with judgements on a number of headline criteria (14 in most of our tests). A further marking exercise on a selected sample of scripts then categorises the fine details of the response through a set of yes/no questions that markers are required to ask of the pupils work. The resulting combination of yes's/no's acts as a unique fingerprint of the script which can then be matched both to the holistic mark and to the judgements against the 14 initial criteria. The whole data gathering exercise is further supplemented with pupil and school background data that describes such things as the pupils curriculum, their ability level and the size and type of school. The anonymity of pupils and schools is of course guaranteed.

We are therefore in a position to analyse the data at various levels. Holistically we can describe what pupils can do; eg. "25% of the population can achieve a 4 on this test". But for diagnostic purposes that is not very helpful, because what we need to know is what they did to achieve fourness (ie. what is fourness?) and how it came about that they had the capability to perform at that level. For these answers we have to relate the holistic data to the headline data and to the background data.

In this way we are gradually building up a picture of what holistic capability is like and what it comprises - of which I shall be saying more later. At this point however, it is interesting to reflect on the treatment of holism that I see being suggested in the NC Working Group Report. Despite the fine words on holism throughout the Interim Report and the Final Report there appears to be some confusion as to what it is. All the discussions of holism refer to it as a subtle blend of capabilities an integrating capability more than the sum of its parts etc. etc. And yet when the Final Report finally gets round

to dealing with it at an operational level, it is reduced to the crudest piece of arithmetic "trailing edge" aggregation that one could imagine.

What the report conspicuously (perhaps inevitably) failed to provide was descriptors of holistic capability. It describes in great detail what capability is like within an AT, but not what genuine design and technology capability is like in its integrated, holistic form. Without such descriptors, holism cannot reliably be left as a matter of judgement, so QED it has to be a matter of arithmetic and this subtle integrated capability can now safely be left in the hands of a computer!

It is greatly to be hoped that as it becomes possible to provide these descriptors of holistic capability, then NC SATs and TAs can increasingly employ them. We believe that within the next few months, the analysis of our data will enable us to begin constructing these descriptors at a number of levels especially in relations to KS3-4.

ISSUES IN THE PRELIMINARY ANALYSIS OF DATA

As I explained last year, the assessment framework that forms the basis of all our marking is organised under the headings of the procedures of design and technology, the means by which pupils manifest or communicate their intentions, and the conceptual platform that they employ in tackling the tasks that we set. As all our marking is built around these distinctions, we would expect to be able not only to report about them but also about the relationships between them.

Today however, I propose to devote the majority of my comments on the preliminary data analysis to the procedural elements of the framework. This is partly because they have a natural priority in the nature of design and technology, but also because they have already started to yield some interesting insights into the nature of capability. Before looking at the data itself however, it is worth pointing out that all markers have been cross marked not only by a second marker but also by an APU team member. Despite the complex nature of the tests and the even more complex nature of the marking, we have produced very acceptable correlation coefficients between individual markers and the APU team. We are confident that the data itself is reliable.

The model of design and technology that we have put forward in our publication would lead us to anticipate that when looking at the way pupils use procedures and concepts, capable of design and technologists would score consistently well on procedural headlines whilst using knowledge (their conceptual platform) selectively to resource their work. Fig 3 shows the breakdown of holistically high performers and low performers in tests 2A 2C and 2E (domain 2 Early Ideas). It is immediately apparent that performance on the procedural headlines is much more consistent through the three contexts than is performance on the conceptual headlines. Pupils are being very selective about the knowledge areas they are employing but not about the central procedures of design and technology. This is comforting but hardly surprising.

However, a much more interesting and potentially important trend emerges when we start to analyse the relationship between the procedural headlines and the holistic score. In analysing the procedural headlines we have started to make a distinction between those that are essentially active (eg. making design proposals re. the user, or re. manufacture) and those that are principally reflective (eg. identifying the issues that lie in the task, or appraising the quality of ideas).

Fig. 4 shows the relationship between these active and reflective headlines and holistic scores. It seems that holistic success it is not simply a matter of scoring well on all headlines, but more importantly a matter of integrating combinations of these qualities. Good scores in 2 reflective headlines will give a holistic score approximately equal to that associated with good scores in 2 active headlines. But good scores in one type will yield a significantly better holistic score, and our really high performers do well in two of each.

It is almost as if there are two sides to capability, the dynamic active side and the more reflective analytical side and both are vital to high level performance. Again this validates the model we initially proposed for we argued, in our mind/hand model, that progression and development in design proposals goes hand in hand with critical self-appraising capability. They have a symbiotic relationship

such that as ideas begin to take form they can be subjected to ever more detailed scrutiny, and that this scrutiny itself feeds the further development of the ideas.

In an attempt to understand this more fully we have begun to analyse not only good holistic responses but also those that show what we might call one-sided development - a preoccupation with either the reflective or the active - and it starts to look as though there are consistent trends in terms of gender, curriculum and ability.

We are not yet in a position to make any firm statistical claims about the trends we are beginning to unearth, but after only 3 weeks of intensive analysis we can be confident that a picture will emerge in the next few months that will go a long way towards clarifying our understanding of the nature of capability in design and technology. At the moment it is like trying to piece together a jigsaw. We have turned all the pieces the right way up and have already positioned some of the corners and many of the outside bits as well as some of the major patterns in the picture. But there remains much confusion and an awful lot of sky.