Early encounters with the Nuffield approach to design and technology

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Early encounters with the Nuffield approach to design and technology

Nick Givens
University of Exeter

Abstract

The Nuffield Design and Technology (D&T) Project (henceforth "the Project") recently published extensive curriculum materials. This paper presents a pilot investigation based on case studies of two teachers in separate schools, each using Nuffield publications with one class. It explores:

• how Nuffield materials were selected and adapted by teachers
• the resulting balances between in-house and Nuffield influence
• teachers' intuitive evaluations of the materials' impact

Both teachers “injected” similar Nuffield elements into existing schemes; they took ownership, exploiting the materials’ flexibility. Both prescribed the mechanical / structural elements of the product, but allowed extensive pupil autonomy over aesthetic elements. Text books were initially underused. In describing the materials’ impact, one teacher emphasised pupils’ learning, the other the improved quality of his own experience. The paper suggests that even a little training may greatly enhance teachers’ use of Nuffield resources.

The Nuffield D&T curriculum materials were developed throughout the period of National Curriculum implementation and subsequent revision in England and Wales. McCormick describes the outcome1:

"Nuffield have aimed quite clearly at the National Curriculum and have hit the target". (p95)

It was not a foregone conclusion that the Project’s resources would be applied in the spirit in which they were intended, or embedded in everyday classroom practice. As Bloomer2 observes,

“Teachers are not merely points in some conduit linking centralised prescriptions to learners’ desks. They are not technicians, faithfully acting out the detail of prescribed blueprints. Rather, they ‘act upon’ prescriptions in order to create learning opportunities.” (p 137)

Indeed, teachers’ capacity to reject prescriptions for D&T is described by Paechter3.

The Nuffield Project sought to respect teachers’ agency in their creation of learning opportunities and learners’ agency in responding to them, while recognising the National Curriculum as a statutory prescription against which both teachers and learners would be assessed. The Project set out to support teachers to meet and exceed the statutory requirements from various starting points; some would be seeking to refine a thriving curriculum from a position of confidence and strength; others, while aware of gaps or weaknesses in their work, would grasp new ideas with enthusiasm and confidence; there may also be some who, having lost confidence, would welcome prescription. The Project held the view that in order to fully exploit Nuffield D&T resources, teachers needed to understand the “Nuffield approach” to D&T, described by DATA4:

“The key idea (is that of) teaching through sequences of tasks designed for specific learning purposes” (p 1)

The types of task are described below. When publication of the Project’s materials was delayed, pending publication of the new National Curriculum, the Project released a set of preview materials, supported by a commentary5, only to those teachers who attended local INSET courses. McBrien6 gives a teacher’s evaluation:
The Nuffield Design and Technology INSET Guide and the related introductory session on the Nuffield approach had enabled the whole... team to develop an appreciation of the approach and the supporting materials. (p 74)

There are precedents for making training a prerequisite to the purchase of materials: the “Man: A Course of Study”7 programme is an example. The aim of these courses was to familiarise teachers with the Nuffield approach to D&T, with the structure of the materials, and to address a concern also identified by McCormick1 about how teachers came to understand and develop the sophistication that is built into the materials. (p 98-99)

Since publication, the Project has supported users through a newsletter8 and a network of Area Field Officers whose brief includes supporting teachers in best exploiting the teaching and learning resources.

This paper presents a pilot investigation, intended to inform a wider survey of Nuffield users. It is based on case studies in two schools in the South of England, in each of which one class has been observed undertaking a “design and make assignment”. Field notes were informed by observation and informal conversations with pupils and teachers. Evidence was also taken from pupils’ work, and tape recorded semi-structured interviews with small groups of pupils. All the names used in this paper are pseudonyms.

Collett’s School is an urban mixed comprehensive of approximately 700 pupils, most of whom came from one estate in a large city; Stanier’s School, also a mixed comprehensive, takes pupils (approximately 1460) from a small town and it’s rural surroundings. The two state schools are controlled by different local education authorities. They were selected on the basis of the willingness of schools and teachers to take part. It was also necessary that the teachers displayed an open attitude to the Nuffield materials. Mr Sikorsky, a former mechanical engineer, was in his fifth year of teaching at Stanier’s; Ms Conran, a former interior designer, was in her second year at Collett’s; both had entered teaching through 2-year degree routes. Neither had attended Nuffield key stage 3 INSET, or received the INSET Guide5. Both teachers chose the class to be observed (year 8 (age 12-13) in both cases), the “design and make assignments” (“Capability Tasks” in Nuffield parlance) for the term’s project work, and the manner of adoption of the Nuffield materials. They did not know or communicate with each other.

**Choice and implementation of Capability Task**

Common practice in England and Wales uses a design and make assignment (“Capability Task”) to structure a complete scheme of work, often for one term; in teachers’ conversations, “project” and “scheme of work” are used interchangeably. Nuffield D&T materials offer plans for thirty-four design and make assignments, intended4 both to teach and reveal pupil capability and (to) require pupils to use the knowledge, skill and understanding learned through Resource Tasks. (p 1).

Eight of these have a significant emphasis on applying knowledge and skill relating specifically to mechanisms.

Ms Conran and Mr Sikorsky chose the same assignment, “Times Past 3”. Figure 1 summarises the information given in the Capability Task File9 and shows the extent to which each teacher incorporated elements of the task in their own schemes of work.

Ms Conran used the task setting provided, i.e. a museum seeking toys to contribute to an exhibition on Victorian times, and also to be sold in the museum shop; Mr Sikorsky used his own task setting, namely an environmental organisation seeking designs for mechanical toys to convey an environmental message, and to be sold for fund-raising.

Ms Conran summarised her aims as:
1) research
2) understanding about briefs and specifications
3) understanding a drawing of an existing product
4) translating (2) and (3) into their own creative work

while Mr Sikorsky aims were to:

1) introduce pupils to mechanisms in a practical way
2) build up students’ confidence and capability in designing, presenting ideas and making
3) encourage safe working and careful use of materials.

The values most commonly discussed in observed lessons were technical, relating to reliability, accuracy, robustness, consistency in design and manufacture. In addition, environmental value judgements underpinned the task setting at Stanier’s (Mr Sikorsky).

Of the eight suggestions offered for nature of product both teachers confined their pupils

<table>
<thead>
<tr>
<th>Times Past 3 Capability Task (design and make assignment):</th>
<th>incorporated in work at Stanier’s</th>
<th>incorporated in work at Collett’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To use d&amp;t resources to consider home life in times past and compare it with today.</td>
<td>x</td>
<td>✔</td>
</tr>
<tr>
<td>Task Setting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A museum seeks facsimile toys as hands-on exhibits in an exhibition on Victorian childhood</td>
<td>x</td>
<td>✔</td>
</tr>
<tr>
<td>Aims</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Research past lifestyles.</td>
<td>x</td>
<td>✔</td>
</tr>
<tr>
<td>2. Produce robust toys.</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>3. Present comparison of past and present childhood through exhibits and oral presentation.</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Values</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(reliability, consistency)</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Economic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(compare Victorian/present toy costs)</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Environmental</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(compare materials used for toys: Victorian/present)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(compare role of play Victorian/present)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(compare role of play Victorian/present)</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Aesthetic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(compare appearances Victorian/present)</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Nature of product</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• board games</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>• hand operated mechanical toys</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>• clockwork toys</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>• zoetrope</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>• musical boxes</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>• toy soldiers</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>• dolls’ house plus furniture</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>• hand games</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Figure 1 - continued over page
### Technical knowledge and understanding

<table>
<thead>
<tr>
<th>Topic</th>
<th>✔</th>
<th>✔</th>
</tr>
</thead>
<tbody>
<tr>
<td>simple mechanisms</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>resistant materials (cutting, shaping,</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>forming, joining, finishing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>connecting/disconnecting components</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

### Tools, materials and equipment

<table>
<thead>
<tr>
<th>Topic</th>
<th>✔</th>
<th>✘</th>
</tr>
</thead>
<tbody>
<tr>
<td>softwood, plywood, metal rod</td>
<td>✔</td>
<td>✘</td>
</tr>
<tr>
<td>metal tube &amp; sheet</td>
<td>✘</td>
<td>✘</td>
</tr>
<tr>
<td>hardboard</td>
<td>✔</td>
<td>✘</td>
</tr>
<tr>
<td>fixing, fittings, adhesives</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>wheels</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>gear wheels, pulleys, belts</td>
<td>✘</td>
<td>✘</td>
</tr>
<tr>
<td>measuring and marketing tools</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>cutting and shaping tools</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

### Cross-curricular links

<table>
<thead>
<tr>
<th>Topic</th>
<th>✔</th>
<th>✘</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using mathematics (costing)</td>
<td>✘</td>
<td>✘</td>
</tr>
<tr>
<td>Using science (material properties)</td>
<td>✘</td>
<td>✔</td>
</tr>
<tr>
<td>Using art (Victorian Arts)</td>
<td>✘</td>
<td>✘</td>
</tr>
<tr>
<td>Using other subjects (History)</td>
<td>✘</td>
<td>✔</td>
</tr>
<tr>
<td>Using IT (databases)</td>
<td>✘</td>
<td>✔</td>
</tr>
<tr>
<td>Using economic &amp; industrial understanding</td>
<td>✔</td>
<td>✘</td>
</tr>
</tbody>
</table>

### Using Resource (short focused) tasks:

#### For Strategies

<table>
<thead>
<tr>
<th>Topic</th>
<th>✔</th>
<th>✘</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using image boards 1</td>
<td>✘</td>
<td>✔</td>
</tr>
<tr>
<td>Using image boards 2</td>
<td>✔</td>
<td>✘</td>
</tr>
<tr>
<td>Appreciating products - style</td>
<td>✘</td>
<td>✔</td>
</tr>
<tr>
<td>Appreciating products - colour</td>
<td>✘</td>
<td>✔</td>
</tr>
<tr>
<td>Modelling movement</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Evaluating outcomes - winners losers</td>
<td>✘</td>
<td>✔</td>
</tr>
</tbody>
</table>

#### For Resistant Materials

<table>
<thead>
<tr>
<th>Topic</th>
<th>✔</th>
<th>✘</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adding decoration</td>
<td>✘</td>
<td>✔</td>
</tr>
<tr>
<td>Redesiging wooden toy for mass production</td>
<td>✘</td>
<td>✔</td>
</tr>
</tbody>
</table>

#### For Mechanical Control

<table>
<thead>
<tr>
<th>Topic</th>
<th>✔</th>
<th>✘</th>
</tr>
</thead>
<tbody>
<tr>
<td>changing force, speed and distance</td>
<td>✘</td>
<td>✔</td>
</tr>
<tr>
<td>Assembling mechanisms</td>
<td>✘</td>
<td>✔</td>
</tr>
<tr>
<td>Introducing mechanism design</td>
<td>✘</td>
<td>✔</td>
</tr>
<tr>
<td>Gear ratios</td>
<td>✘</td>
<td>✔</td>
</tr>
<tr>
<td>conveying belt calculations</td>
<td>✘</td>
<td>✔</td>
</tr>
</tbody>
</table>

### Case Study

<table>
<thead>
<tr>
<th>Topic</th>
<th>✔</th>
<th>✘</th>
</tr>
</thead>
<tbody>
<tr>
<td>Printing technology - from wood block to computers</td>
<td>✘</td>
<td>✔</td>
</tr>
</tbody>
</table>

---

Figure 1
to one, i.e. “hand operated mechanical toys”. They further controlled the task by prescribing the mechanisms which pupils should make. At Collett’s, they were required to choose a mechanism from pictorial line drawings in a hobby text of some vintage, whereas at Stanier’s, Mr Sikorsky demonstrated to the whole class the step by step construction of a standard wooden carcass, with axle, eccentric wheels and vertical followers. Pupils’ technical autonomy was limited to the translation from illustration to product at Collett’s, and to decisions concerning the number, size and axial location of eccentrics, and choice of rotating or oscillating outputs, at Stanier’s. Both teachers afforded pupils much greater autonomy when it came to the characterisation of the output components of the toy in keeping with the task setting (Victorian or Environmental).

Technical knowledge and understanding and tools, materials and components very much reflected established practice, and the Capability Task recommendations largely matched the selections made by Ms Conran and Mr Sikorsky.

Cross-curricular links were not visible to the observer.

“Resource Tasks” (equivalent to National Curriculum “short focused tasks”) are:

short, practical focused activities designed to teach a particular piece of technical knowledge, design strategy, making skill or value appreciation in a way which should intrigue and amuse pupils (p1).

Neither teacher incorporated the Resistant Materials Tasks (which focused on decoration, and redesigning a wooden toy for mass production) or the Mechanical Control Tasks; both chose only “Strategy” Resource Tasks, which focus on design skills. This approach was described by Ms Conran as:

“predominantly consisting of Nuffield work in the design aspects, but School-originated work in the making aspects”. (videoconference notes, 16/10/96)

Both teachers used Strategy Resource Tasks to teach about “Image Boards” and “Modelling Movement”. Ms Conran modified a task, which invited pupils to research and create a collage of images, to focus on the Victorian period of British history. Mr Sikorsky used a similar task involving production of image boards to contrast “Green” and “Greedy” lifestyles. Both teachers used the “Modelling Movement” task, in which pupils use lollipop sticks, card and paper fasteners to model a cam and lever system, which makes a cardboard skull appear to talk.

Ms Conran also set “Winners and Losers” (a product evaluation activity) and “Appreciating Products - Style”. Of the twelve Resource Tasks suggested therefore, two were used by one teacher, four by the other. Resource Tasks not specified for “Times Past 3”, were also selected (“writing design briefs” at Collett’s, "drawing quick 3D views:" and "spot the mechanism" at Stanier’s).

The Case Study, “Printing technology - from wood blocks to computers”, was not used by either teacher; indeed, the entire Study Guide 12, which offers 35 case studies and a discussion with pupils of how to “do”, learn and improve in D&T, went unused. Ms Conran explained that:

"I don’t use the Study Guide; to read them in school would take up too much ‘practical’ class time, and while the case studies would make good homeworks, I am reluctant to send the books home." (Videoconference notes, 16/10/96).

Pupils at Collett’s tackled the term’s work in groups of three to five; at Stanier’s, pupils worked individually throughout the term.

Responses and perceptions

All Resource Tasks use an ideogram to highlight page numbers in the Students Book which support that Task. Initially these references were not used in either class; it transpired that neither teacher had registered their significance. Alerted to the ideograms’ purpose, pupils became accustomed to using the text to help them tackle Resource Tasks.

Ms Conran expressed the impact of Nuffield largely in terms of her pupils’ responses,
referring to what they had learned, e.g.

“when I now ask them to write a design brief, some pupils will say to me ‘do you want an open brief or a closed brief, Miss?’”
(Field notes, 4/8/96)

She was enthusiastic about their response to “Appreciating Products - Style”. This required pupils to cut drawings of household objects and paste them in named groups according to style. Of the thirteen examples seen, five used original descriptors, e.g.:


four used ‘Victorian’ as a descriptor;

three named other periods, e.g.

suggesting possible transfer of knowledge from history lessons, or external sources:

“I found this homework quite hard, e.g. 1 hour instead of 30 minutes. But I enjoyed looking up information”. (Extract from pupils’ lesson log)

This reveals thoughtful treatment of the task, constituting a valuable start to the development of vocabulary for aesthetics.

Commenting on “the most effective aspect” (of Nuffield D&T), Ms Conran offered:

“the resource tasks, and pupils being able to dip into the Students’ Book a lot”, (Field notes, 4/12/96)

adding that pupils

“had done very well in learning to work from work sheets, and not depend on me so much.” (4/12/96)

Later she reported:

“Nuffield is now part of a way of life, the students’ book gets handed out every lesson.”
(Field notes, 15/1/97)

She also valued pupils’ learning about:

“mechanisms and how they work, what linkages are for, changes of movement”. (Field notes, 4/12/96)

The “design and make” work was completed by only one group of pupils at Collett’s; another nearly finished, the remainder having run out of time without completing their product. Ms Conran was, nevertheless, positive about the term’s work:

“They didn’t seem to mind having no product to take home. They understood that it was about product design and development, and that they would also learn about mechanisms.” (4/12/96)

She reported that pupils had said:

“it’s the best bit of work we have ever done”, (videoconference notes, 4/12/96).

and suggested that:

“it’s because we worked them so hard that they enjoyed it so much.” (4/12/96).

At Stanier’s, Mr Sikorsky expressed the impact of Nuffield in terms of his own experience rather than that of pupils:

“We are going in a similar direction but with better resources. The way it is helping me is that there are resources that I can just use, without much adjustment, which give qualities to what I do, giving more depth and colour to the work.” (Field notes, 5/11/96)

He gave as one example the “Green & Greedy” image board Resource Task:

“While I don’t like the Greedy notion I did like the task as a way of thinking about what ‘Green’ means” (5/11/96)

Mr Sikorsky had also used Nuffield materials with other classes. For example, he created a new “in house” resource task to engage pupils with information about properties of materials:

“it’s giving me a bit of divergent thinking, for example, resistant materials” (he formerly taught resistant materials by giving notes) “now I’ve seen the metals chooser chart, I can cut the names off and
get pupils to match the charts to material
samples, adding extra clues to the charts.
This will replace a lot of writing; it’s more
interesting, involves pupils more. I did
this with a class which didn’t handle the
traditional way very well and they
produced nice quality sheets at the end.”
(Field notes 5/11/96)

More generally, he said:

“It was easier for me, having better quality
of resources, and resources which are
useful for extension work, for example,
help with 3-D drawing”, (Field notes 16/
12/96)

and welcomed the:

“clarity and presentation of worksheets”
(Field Notes, 5/11/96).

and

“good quality drawings that look up to
date, that don’t put pupils off, don’t look
like the 1960’s and 1970’s.” (5/11/96)

contrasting this to:

“the office library is full of old Ladybirds
and books from the 1960’s” (5/11/96)

**Questions to explore**

This study has taken snapshots of two first
counters with a published curriculum
scheme. While the extent to which they
represent the wider situation remains to be
explored, it is worth highlighting salient
features.

Given the differences between the schools in
the study, the similarities in the two teachers’
responses to Nuffield D&T resources are
remarkable. Both teachers employed a
cautious strategy in adopting the Nuffield
scheme, that of “injecting” some elements of
Nuffield D&T into their existing scheme of
work, while largely retaining their existing
methodology. This strategy is echoed by
McBrien:

“It was felt that good work should be built
on and the extra workload of new schemes
should be kept to a minimum”. (p 75)

In both cases, the major ingredients of the
injection were Strategy Resource Tasks (which
address design skills) selected both from
within and beyond those recommended for
the chosen capability task.

The nature of pupils’ opportunity to develop
capability was strikingly similar in both cases:
tight teacher prescription of the mechanical/
structural elements of the product, but
extensive pupil autonomy over aesthetic
elements. In neither school were pupils
directed to use the Students’ Book to support
their Resource Task work, until the author
questioned this. Neither teacher encouraged
pupils to use the Study Guide, either for the
Case Studies or for the support for learning
in D&T.

The teachers differed in how they described
the impact of the Nuffield resources. While
one emphasised the learning that she had
observed, including the study skill of working
from worksheets and texts as a step towards
autonomy, the other highlighted the added
depth and colour that Nuffield materials had
brought to his work.

Whereas on the surface it might appear that
the ‘injection’ strategy constitutes a limited
sampling of Nuffield resources, what we have
actually seen is a sophisticated exploitation
of their in-built flexibility in order to meet the
requirements of teachers’, who have taken
ownership of the materials by, for example:

- adapting the Capability Task setting
- adapting Resource Tasks
- critically selecting Resource Tasks
- creating a new Resource Task by adapting
  a ‘chooser chart’ from the Students’ Book

It is promising that this level of engagement
took place in a ‘first encounter’ with Nuffield.

The study begs a number of questions:

i) whether the above findings are
representative of a wider picture; more
specifically,

ii) how will teachers’ engagement with
Nuffield resources develop as they gain
experience?

iii) is there a subject culture that does not see
books as a useful aid in practical lessons?

iv) if the answer to (iii) is yes, is there a need
to raise the profile of study skills in D&T?
v) when pupils gain knowledge and skills through undertaking Resource Tasks, do they subsequently apply these in their designing and making, i.e. are Resource Tasks successfully used to develop ‘D&T Capability’?
vi) in setting D&T tasks is it common practice for teachers to exercise considerable control over the technical elements of products (e.g. mechanisms), while giving pupils more autonomy than is helpful when it comes to the aesthetic elements? (See 14 for an analysis of factors in task design).

A review\(^{15}\) of another D&T curriculum project suggests that:

> promoting change is difficult... and without extensive in-service training the materials themselves must carry much of the training burden. (p186).

This preliminary study reveals that two teachers, with negligible training in the opportunities provided by the Nuffield D&T materials, used them with surprising sophistication, and that a little training made considerable difference to the extent to which they were able to use the full range of resources provided by the published materials.

References


