Re-Building
Design &
Technology

David Barlex
Torben Steeg
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Torben Steeg

Acknowledgements
Nick Givens helped initiate the thinking that has led to this paper and has provided invaluable advice during its development. However, David and Torben take responsibility for all errors.

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He is a member of the editorial board for the D&TA’s ‘D&T Education; An International Journal’, a founder editor of the on-line journal ‘ECT Education’ and a Fellow of the RSA.
He has provided advice, curriculum development and CPD activity to a wide range of organisations and is the author of a range of general and academic publications.
He is an active participant in Manchester’s maker community and since 2012 has been an organiser of the Manchester Maker Faire/MakeFest.

Nick Givens
Nick is a Senior Lecturer in Education at the University of Exeter Graduate School of Education. He taught in several comprehensive schools- becoming head of design & technology - and subsequently established a design & technology department from scratch in a Sixth Form College.
Since moving into university-based initial teacher education, he has taught undergraduate and postgraduate design & technology trainee teachers, led an undergraduate teacher education programme and a postgraduate design & technology teacher education course. He has also been an author and a field officer for the Nuffield Design & Technology Project.
His research interests include curriculum development in design & technology, inclusivity within education and, most recently, approaches to teaching about ‘disruptive’ technologies.
Introduction

This paper has been developed in response to the serious and continuing decline in the uptake of GCSE design & technology since the subject was introduced into the National Curriculum in 1989. At that time, some 95% of young people studied the subject to the age of 16+. Since then this has fallen to about 28% (Mitchell 2016) and, with the removal of food from design & technology specifications, it is predicted to fall much further.

Rather than identify the many and varied reasons why such a decline has taken place, we develop the substance of four features of the school subject design & technology which we believe are essential if the subject is to reverse its decline and start, once again, to make a significant contribution to the education of the majority of young people.

These features are:
1. Sound epistemology
2. Clarity of purpose
3. Good practice
4. Informed stakeholder perception

The paper continues by exploring how each of these can be achieved:
5. Achieving sound epistemology
6. Achieving clarity of purpose
7. Achieving good practice
8. Achieving informed stakeholder perception

The task of rebuilding design & technology is one that will require the whole design & technology community to pull together in the same direction. One of our purposes here is to map out the right direction, the second is to suggest ways in which the community might work together to move in that direction. Inevitably many of our recommendations are to the D&T Association as a key and leading organisation within our community. However, we wouldn’t want to give the impression that we think the task is theirs alone; rebuilding is a daunting task that will require all of us to work together alongside the Association.
1 Sound epistemology

Design & technology is rightly concerned with procedural knowledge (knowing how) but a neglect of the underlying conceptual knowledge (knowing that) has led to the subject being perceived as having less worth than other subjects in the curriculum and concerned only with skills. It is important to address this misconception and one way to do this is to clearly define ideas about design & technology (ideas that describe design & technology’s fundamental nature) and ideas of design & technology (ideas that form the conceptual knowledge underpinning of the subject).

Ideas about design & technology might include:

<table>
<thead>
<tr>
<th>Ideas about design &amp; technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Through design &amp; technology people develop technologies and products to intervene in the natural and made worlds</td>
</tr>
<tr>
<td>Design &amp; technology uses knowledge, skill and understanding from itself and a wide range of other sources, especially but not exclusively science and mathematics</td>
</tr>
<tr>
<td>There are always many possible and valid solutions to technological and product development challenges, some of which will meet these challenges better than others</td>
</tr>
<tr>
<td>The worth of technologies and products developed by people is a matter of judgement</td>
</tr>
<tr>
<td>Technologies and products always have unintended consequences beyond intended benefit which cannot be fully predicted by those who develop them</td>
</tr>
</tbody>
</table>

Table 1

Ideas about design & technology describe design & technology’s fundamental nature
Ideas of design & technology might include:

<table>
<thead>
<tr>
<th>Knowledge of materials</th>
<th>Sources</th>
<th>Properties</th>
<th>Footprint</th>
<th>Longevity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of manufacturing</td>
<td>By subtraction</td>
<td>By addition</td>
<td>By forming</td>
<td>By assembly</td>
</tr>
<tr>
<td>Knowledge of functionality</td>
<td>Powering</td>
<td>Controlling</td>
<td>Structuring</td>
<td></td>
</tr>
<tr>
<td>Knowledge of design</td>
<td>Identifying peoples’ needs and wants</td>
<td>Identifying market opportunities</td>
<td>Generating, developing and communicating design ideas</td>
<td>Evaluating design ideas</td>
</tr>
<tr>
<td>Knowledge of critique regarding impact</td>
<td>For justice</td>
<td>For stewardship</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2
Ideas of design & technology

Taken together the ideas about and the ideas of design & technology are the subject’s Big Ideas (Harlen et al, 2010).

These Big Ideas are summarised diagrammatically in Figure 1 (overleaf).

Ideas of design & technology form the conceptual knowledge underpinning of the subject
Barlex (2014) provides a detailed justification for this approach to design & technology and for the content of the ideas about and ideas of design & technology education.
2 Clarity of purpose

We can envisage the school curriculum as learning composed of a jigsaw of different subjects where each subject makes a significant and unique contribution to that learning.

To become a rounded and successful member of society a young person will need learning from each of the pieces. If learning from any piece is marginalized or missing, then the young person will be at a disadvantage. Those concerned with the learning that takes place in any specific piece must be able to identify the essential learning that takes place in contributing to the young person’s overall education.

Note that this ‘jigsaw of subject pieces’ model for the curriculum need not be static. The individual pieces may change position and join with other pieces in response to particular teaching and learning intentions.

For example, the pieces for science, mathematics and design & technology may become joined in response to STEM.

Or design & technology might be joined with geography and science in response to a consideration of climate change issues.

Or design & technology might be joined with history in teaching about the impact of technology on society.

Hence the jigsaw piece model goes some way to mitigating the problem of subject silos.

If each subject is a piece in the jigsaw that overall provides a good education, what then governs the status of any single subject?
The contribution of some school subjects to a young person’s overall education is simply not contested e.g. mathematics, English and science. Other subjects have established themselves as highly desirable and there is high encouragement for pupils to study such subjects to the age of 16 years e.g. history, geography, a language. Taken together these subjects have been compiled into a suite of subjects, designated as the EBacc by the government, whose purpose is to provide information to parents, and others, about the achievements of pupils in a core set of academic subjects which are believed to enhance the chances of progressing on to further study. To meet EBacc criteria, a pupil must have obtained a grade A* to C in English, maths, two sciences, history or geography (referred to as humanities), and an ancient or modern foreign language.

To be taken seriously by those concerned with young people’s education a subject outside the EBacc must be very clear about the contribution it makes to their learning, particularly regarding its uniqueness (i.e. the learning is not provided by any of the other jigsaw pieces) and its rigour (both practical and intellectual). This is the challenge facing design & technology.

It is important to understand the possible justifications for teaching design & technology. Here are four different arguments (following the terms used by the Expert Panel (DfE, 2011, p15)) which, it is important to note, are not mutually exclusive.

**An economic argument**

A steady supply of people who have studied design & technology is essential to maintain and develop the kind of society we value. Design & technology is central to the innovation on which our future economic success as a nation depends. For those young people who achieve a design & technology qualification at school the experience may well predispose some of them to consider a technical career. This is important as our country faces a “STEM skills” gap.

**A personal argument**

The learning achieved through studying design & technology at school is useful in everyday situations as it enables young people to deploy design skills and technical problem solving to address and solve practical problems.
A social argument
In their communities, their workplaces as well as through the media, people encounter questions and disputes that have matters of design and/or technology at their core. Often these matters are contentious. Significant understanding of design and of technology is needed to reach an informed view on such issues and engage in discussion and debate.

A cultural argument
Technologies and the design thinking behind them are major achievements of our culture, so everyone should be helped to appreciate these, in much the same way that we introduce them to literature, art and music.

Exploring these arguments
The economic argument is difficult to justify as an argument for teaching design & technology to all young people, as the total of professional engineers, technologists and designers is only a few per cent of the whole population of an industrialized country. However, employers might argue that unless a high percentage of the school population is exposed to design & technology then not all of those who might be inclined to take up careers in this area will be reached. Nevertheless, the foremost goal of a general design & technology education cannot be to train the minority who will actually “do” technology as a career.

The personal argument can be extended to a consideration of the personal qualities developed by being able to deploy design and technical problem solving skills. The creative activities of design and making, which are a major part of design & technology courses, not only give immense personal satisfaction but, importantly, develop a sense of self-efficacy which provides young people with a positive self-image about their ability to be successful. We have no doubt that these are important elements of a rounded education, and ones that design & technology is uniquely able to provide, but we don’t believe that they are sufficient to justify the subject’s place in the curriculum. The expert panel for the 2011 Curriculum Review took a similar view arguing that design & technology did not have;

sufficient disciplinary coherence to be stated as (a) discrete and separate National Curriculum ‘subject’ (DfE, 2011, p24)

(Fortunately other views prevailed and design & technology was retained as a National Curriculum subject at that time; we cannot be optimistic that any future curriculum review would have the same outcome.)
The role of education to produce informed citizens able to take an active role at various ‘levels’ in their community and able to engage in informed and rationale debate lies at the heart of the social justification for the subject. There seems little doubt that the pace of technological development is accelerating (some argue that it is doing so at an exponential rate (Kurzweil, 2005)). While new technologies have always created a degree of concern in certain elements of society, it is noteworthy that some of the worries being expressed about imminently widespread new technologies are coming from within the technology community itself (e.g. Achenbach, 2016). Even if one takes a reasonably sanguine view, many of these new and emerging technologies are likely to have significant impact on society, almost certainly being disruptive (Barlex, Givens & Steeg, 2015) to many current practices in people’s personal, social and working lives. There is clearly a need for an informed public discourse about the development and deployment of such technologies. This is the nub of the social argument: Enabling the public to contribute significantly and intelligently to such discourse.

The cultural argument forces us to ask, “What are the grand narratives of design & technology?”. There have been moments in time when the outcomes of design & technological doing and thinking have had a profound effect on human history. Early in the story the development of cooking, the invention and development of simple tools from flint and bone, the ability to refine ores to produce metal, the ability to grow and farm crops and livestock, the production of shelters, the development of clothing made huge differences to the quality of life. Basic needs could be met more easily, leaving time and energy available to develop cultural identity through a wide range of creative and commercial activities. Subsequently there has been a succession of technological ‘revolutions’, the industrial revolution and the information revolution being among the most recent. These have all been enabled by humanity’s ability to envisage what might be and take action to realize such as yet unreached circumstances. So, any grand narratives of design & technology must consider imagination and intervention. Such imagining must of course be grounded in the realities of the physical universe; more and more the scientific understanding of the phenomena that constitute the physical universe underpin the interventions that result from the imagination. The variety and impact of the interventions are key components of the grand narratives. The interventions stemming from an imagined but

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1 Information on our Disruptive Technologies Project is available at: https://dandfordandt.wordpress.com/projects/disruptive-technologies/
The story of humanity’s interventions, their variety and consequences both intentional and accidental provide the grand narratives of design & technology. And they reveal the nature of the Big Ideas underpinning the subject:

- Intervention in the natural and made worlds
- How this intervention uses knowledge, skill and understanding from a wide range of sources, especially but not exclusively science and mathematics
- That there are always many possible and valid solutions to technological and product development challenges, some of which will meet these challenges better than others
- The worth of technologies and products developed by people is a matter of judgement
- That technologies and products always have unintended consequences beyond intended benefit which cannot be fully predicted by those who develop them

These narratives can be explored through the history of specific technologies, through the lives of individual designers, engineers, architects etc., through the development of different civilisations, through investigating products as well as through the designing and making that children engage in.

We believe that each of these justifications should inform a school design & technology curriculum and, although in each school’s circumstance their relative significance may vary, to produce a curriculum that did not respond in part to each of these arguments would be a curriculum that was lacking an important dimension. However, it seems to be the case that too often the current justification for design & technology rests on the economic and personal arguments. As the above discussion makes clear, we have taken a strong view that these are not sufficient and, indeed, that relying on these puts the future of the subject at risk. By the same token, the cultural and social justifications seem underdeveloped in rationales for the subject and significant effort needs to be made in developing these in ways that teachers can realistically use in design & technology lessons right from the start of the design & technology learning journey in KS1.
We further believe that meeting the totality of these arguments will be achieved by teaching children to achieve a combination of technological capability and technological perspective.

We define these as follows:
Technological capability is designer-maker capability, capturing the essence of technological activity as intervention in the made and natural worlds.

Technological perspective provides insight into ‘how technology works’ which informs a constructively critical view of technology, avoids alienation from our technologically based society and enables consideration of how technology might be used to provide products and systems that help create the sort of society in which pupils wish to live.

Finally, we note that to develop the cultural and social arguments within the design & technology curriculum is no small task. But, if we are right, then it is a task that cannot be left undone and the design & technology community will need to find the means within itself to undertake it.
3 Good practice

The following sentences, derived from the writings of Jacob Bronowski in his seminal work, *The Ascent of Man* (1973), provide a powerful justification for teaching the subject that touches on all four of the arguments noted in the previous section (economic, personal, social, cultural).

*Envisaging what might exist in the future and using tools and materials to create and critique that future is a unique human ability, which has led to the development of successive civilisations across history. It embodies some of the best of what it means to be human.*

*Through teaching young people design & technology schools introduce pupils to this field of human endeavour and empower them to become people who see the world as a place of opportunity where they and others can, through their own thoughts and actions, improve their situation.*

The underlined words and phrases in the justification have considerable implications for the subject as shown in Table 3. These implications in turn inform the pedagogies that will be appropriate.

**Table 3**

*Implications for the subject*

<table>
<thead>
<tr>
<th>Word or phrase</th>
<th>Implications for the subject</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Envisaging what might exist in the future</em></td>
<td>... require students to be imaginative</td>
<td>E, S, C</td>
</tr>
<tr>
<td><em>tools and materials</em></td>
<td>... require students to develop practical skills</td>
<td>E, P, S</td>
</tr>
<tr>
<td><em>create</em></td>
<td>... require students to be imaginative</td>
<td>E, P, S, C</td>
</tr>
<tr>
<td><em>critique</em></td>
<td>... require students to be thoughtful and develop intellectual skills</td>
<td>E, P, S, C</td>
</tr>
<tr>
<td><em>unique human ability</em></td>
<td>... require students to understand the ways that design &amp; technology underpins cultural and social structures</td>
<td>E, S, C</td>
</tr>
<tr>
<td><em>empower</em></td>
<td>... develop students’ self-efficacy</td>
<td>E, P</td>
</tr>
<tr>
<td><em>see the world as a place of opportunity</em></td>
<td>... develop in students a positive attitude toward confronting difficulties and problems</td>
<td>E, P, S</td>
</tr>
<tr>
<td><em>own thoughts and actions</em></td>
<td>... require students to be both reflective and active</td>
<td>E, P, S</td>
</tr>
<tr>
<td><em>improve their situation</em></td>
<td>... require students to make judgments as to what is worth doing</td>
<td>E, P, S</td>
</tr>
</tbody>
</table>
Four broad activities are generally recognised as being required to make up an appropriate pedagogy: designing and making, making without designing, designing without making and considering consequences.

**Designing and making**
This is often seen as the heartland of design & technology education, although it does not reflect the reality of technological activity in the world outside school, where those who design artefacts are usually not those who manufacture them.

The decision making that pupils need to undertake when they are designing and making has been described (Barlex, 2007) as involving five key areas of interdependent design decision: conceptual (overall purpose of the design, the sort of product that it will be), technical (how the design will work), aesthetic (what the design will look like), constructional (how the design will be put together) and marketing (who the design is for, where it will be used, how it will be sold). This is shown diagrammatically in Figure 3.

The interdependence of these areas is an important feature of design decisions, as change of decision within one area will affect some if not all of design decisions that are made within the others. It is the juggling of these various decisions to arrive at a coherent design proposal that can then be realised to the point of fully working prototype that provides the act of designing and making with intellectual rigour and educational worth and makes it an essential part of technology education.

![Figure 3: Pupil design decisions](image-url)
The Nuffield Design & Technology Project\(^2\) coined the term “capability task” for designing and making assignments as it was through attempting such tasks that young people would develop and reveal their technological capability. The Project was very clear as to the need for this activity to be underpinned by two broad areas of knowledge: knowledge of the problem and knowledge for the solution.

Knowledge of the problem
This is usually specific to the problem being addressed and needs to be found by exploring the situation in which the problem is embedded. It cannot be ‘looked up’ in a general design & technology reference text.

Knowledge for the solution
This can be more easily recognised and acquired, in that for any domain of design & technology it does not change as the design task changes. Gears, for example, behave in the same way, in terms of principle whether they are used in a child’s toy, a lawn mower or a motor car although the detailed arrangement and robustness of the gearing system developed to operate in these artefacts will be different. To ensure that students had the practical and intellectual resources with which to be capable, the Nuffield Project devised a wide range of resource tasks which could be used to teach design strategies, technical knowledge and understanding and making skills. It is the learning through resource tasks that enables young people to make sound design decisions.

Making without designing
This also has a place in the pedagogy. Imagine an activity in which Year 7 pupils make (and then fly) a kite. The teacher has provided the plans for the kite and if followed faithfully they are known to produce a kite that flies well. What might a pupil learn from making a simple kite? They would certainly learn making skills involving textiles and resistant materials. Given the nature of kites there is the possibility of teaching about forces in structures as well as key aspects of health and safety. If pupils are given a choice of materials, there is the possibility of carrying out investigations into properties and using the results to decide on which materials to use – both for the fabric and the frame. So, this making without designing activity is very rich in learning the Big Ideas of design & technology as well as acquiring making skill and almost certainly highly enjoyable for the pupils.

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\(^2\) The Nuffield Project’s KS3 and KS4 materials are freely available from: https://dandfordandt.wordpress.com/resources/
Designing without making
This approach was developed extensively by the Young Foresight project as the means to improve the ability to communicate design ideas, cultivate creativity and enable collaboration in design & technology lessons. The independent evaluations (Murphy 2013) of designing without making have shown that young people do not necessarily require ‘something to take home’. Pupils respond enthusiastically to working collaboratively to develop design ideas providing they know at the outset that they would not be going to make their designs. In fact, this ‘not requiring to make’ was welcomed by the pupils as it released them from the constraints of the materials and equipment available in their school workshops.
An important feature of this approach is that pupils themselves decide on the need or want they want to address and make conceptual design decisions accordingly, which provides ownership and motivation. However, the pupils do have to justify their ideas in terms of feasibility, meeting needs and wants, acceptability to society and marketability.

Considering consequences
The opportunity for pupils to consider the consequences of technology and the impact this has on society in general and their lives is an important element of design & technology. Critique is one of the Big Ideas that underpin the subject. It is through learning to critique that young people will be enabled to partake in and contribute to on-going debates about what we do with the technology at our disposal. A simple “winners and losers” analysis, to identify the impact of a product or technology on those who it might affect, is a very powerful way of engaging young people in considering consequences. Identification of “winners and losers” features in both the Nuffield Design & Technology Project and Young Foresight.

We note that it is fairly straightforward to assess each of these types of activity, providing the teacher is clear about the learning intentions underpinning the activity. In summary, any ‘grand plan’ for a design & technology curriculum will need to give each of these four activities appropriate significance. Depending on the age and stage of the pupils the relative significance of these components may vary within each year of the course but there is a strong case that each should be present to some degree within each year.

3 The Young Foresight materials are freely available from https://dandfordandt.wordpress.com/resources/young-foresight/
4 Informed stakeholder perception

We can identify a range of important stakeholders:

- Government
- Teacher Trainers and CPD providers
- SLT and governors
- Teachers
- Parents and pupils
- Awarding and assessment organisations
- OfSTED
- Professional Associations
- Professional Institutions

For each of these stakeholders it will be essential that they have a sound grasp on the following:

- What the subject is about, its nature and bodies of knowledge;
- Why it is important;
- How pupils learn;
- How pupils are assessed;
- The worth of any qualifications pupils might achieve

It is essential that the stakeholder knowledge of the subject is driven by an understanding of its clarity of purpose and sound epistemology, as established by those who lead the community of practice of design & technology education, as opposed to what the stakeholders might wish to be the purpose and nature of the subject.

There has been only limited research (Hardy, 2016) into the beliefs of various stakeholders but this has shown that there is a wide variety of different views, most of which do not reflect sound epistemology and the clarity of purpose established earlier in this paper.

Summary Parts 1 – 4

Only if clarity of purpose and sound epistemology are clearly established as the underpinning orthodoxy can pervasive good practice be developed. These three features are necessary to develop the informed stakeholder perception required to change the status of the subject and reverse its decline.
5 Achieving sound epistemology

Small-scale research in Australia (Williams and Lockley 2012) indicated that science teachers relatively new to teaching had a clear and agreed grasp as to the nature of the subject they taught. This indicates that within the science teaching community there is orthodoxy about epistemology. In contrast to the science teachers, the research indicated that this was not the case for technology teachers. Parallel research (Barlex and Steeg 2013) has revealed a similar situation exists for design & technology teachers in England.

Establishing an agreed orthodoxy regarding the knowledge, understanding, skills and values that make up the school subject design & technology is extremely important. Without this the design & technology community of practice will always be divided as to the fundamental nature of the subject. It was an awareness of this situation that led the Expert Panel (DfE, 2011) set up by the then Minister of Education Michael Gove, to advise that design & technology should not be included as a core subject in the National Curriculum in England. So, a major task for the design & technology community of practice is to identify a design & technology subject knowledge orthodoxy that the majority of teachers, teacher trainers, CPD providers can believe in strongly and use to underpin all the teaching, learning, teacher training and professional development that takes place. This will be no mean feat, but it is one which the Design & Technology Association under the direction of its new CEO should address with some urgency.

We emphasise that it will be essential not to confuse the identification of epistemological orthodoxy with agreement over the reasons why the subject should be taught i.e. its purpose within the curriculum. A pervasive orthodoxy as to what should be taught can be interpreted through pedagogy to reflect the several reasons for teaching the subject. In this way, teaching can be aligned to meeting the needs of different groups of young people without compromising the agreed nature of the subject. By taking this forward the Design & Technology Association would be showing much needed intellectual leadership at a time of significant change.

Recommendation to the D&TA

- Establish an agreed orthodoxy regarding the knowledge, understanding, skills and values for school design & technology.

Establishing an agreed orthodoxy regarding the knowledge, understanding, skills and values that make up the school subject design & technology is extremely important.

By taking this forward the Design & Technology Association would be showing much needed intellectual leadership.
6 Achieving clarity of purpose

Several eminent figures from industry have given their support for design & technology. Not surprisingly this support is often couched in terms of an economic argument. There are two dangers here.

The first danger is that the argument about purpose is often determined on the ground in schools through an assumption that the subject is vocational and, by implication, not suitable or desirable for who have shown themselves to be academically successful. So this narrowed focus has clearly failed to encourage these schools to see the subject as an important part of general education for all young people. However, if the other arguments (personal, social and cultural) that maintain that the subject should be embraced as a part of general education for all young people are successful, then they can be shown to support the economic argument: The more who study the subject the greater the pool from which industry may expect to draw young people into technical or design based careers. Hence it is important that those in industry who are advocates for the subject are aware of arguments other than the economic and use these arguments in their support of the subject.

The second danger is that limiting the number of academically successful young people who study design & technology means that many who go on to professional careers (lawyers, journalists, accountants etc.) will have missed out on the benefits of the subject. They may well be less sympathetic to the design and manufacturing industries.

There is a clear role for the Design & Technology Association here in the way they marshal support for the subject from the commercial world. It has the very important role of ensuring that the messages coming from influential and well known figures in business and industry are not limited to economic arguments but include the other rationales, integrated into powerful and irresistible justifications for all young people to be educated in design & technology. This should not be thought of as the Association adopting a 1984 ‘thought police’ approach in censoring the views of business and industry but rather as an important opportunity to show the intellectual leadership the subject needs.

Recommendation to the D&TA

• Marshall support for a broader view of the purposes of school design & technology to include personal, social and cultural as well as economic aims.
7 Achieving good practice

Teachers are introduced to the features of good practice in their initial training but inevitably there is only a limited appreciation of what this entails. Once a teacher is in post, he or she develops further good practice through their day-to-day teaching and learning from colleagues. This is further enhanced through appropriate CPD. However, it is essential to realize that good practice cannot be achieved in isolation from sound epistemology and clarity of purpose. Any department wishing to develop good practice must first establish agreed statements on what it will be teaching in the subject and why it is teaching the subject. Only once these are established can a department develop an appropriate pedagogy.

Hence any CPD that is provided by the Design & Technology Association or others whose aim is to achieve good practice will need to take all three features into account.

Visually this can be represented as three vectors of ‘what’ ‘why’ and ‘how’ (Figure 4). If we imagine a school department’s journey towards better and better practice, these three vectors of activity need to be considered together in the planning and provision of appropriate CPD. Movement along any one vector will be dependent on movement along the other two vectors.

Given the confusion surrounding the epistemology of the subject and the purposes for which it is taught, it is essential that as much as possible of the CPD provision available in the immediate future should consider each of these three features.
As an orthodoxy about epistemology is reached and the variety of reasons for teaching the subject become more widely understood this requirement may be relaxed with concentration more on how we teach and a focus on those aspects of what we teach that are seen as necessary or relevant at the time. Developing Great Teaching (Teacher Development Trust 2015) provides a useful summary of research into what constitutes effective professional development for teachers and the DfE has published Standard for teachers’ professional development (2016) which reflects the research findings. Two key points are that professional development programmes should be sustained over time and must be prioritised by school leadership. In addition, recent summaries of research into effective teaching practices include those from the Sutton Trust (Coe et al., 2014) and Hattie & Yates (2013); good CPD will need to take these lessons into account.

The sort of professional development supported by research and envisaged by the DfE goes much further than providing a single day of advice about enhancing students’ public examination performance, for example (important though this is). Hence it is vital that design & technology departments are supported in creating a sustained and substantial professional development programme. Such a programme should support the individual needs of teachers within the department and simultaneously develop good practice across the department and contribute to the modernization of the design & technology curriculum.

It is here that we become torn between the ideal situation – regular, related CPD sessions over time with the opportunity to explore and evaluate the impact of changes in practice and the pragmatic reality of what most schools can afford, both in terms of the time available for teacher release and the finances available for CPD. One strategy to overcome these difficulties is for schools to collaborate through common CPD days as is done by some teaching school alliances and MATs. The Design & Technology Association has some key roles to play in promoting good CPD to SLTs and in providing CPD that meets the research and DfE criteria for effectiveness. A further important role for the Design & Technology Association will be in establishing non-governmental financial support to underwrite at least some of the costs of such high-quality CPD.

Recommendations to the D&TA

- Promote and provide CPD that meets the research criteria for effectiveness.
- Establish financial support for effective CPD.
8 Achieving informed stakeholder perception

SLT and governors, teachers, parents and pupils

Influencing these stakeholders will largely need to be undertaken by the subject leaders in individual schools. The D&T Association has a leadership role here through the provision of advice and guidance on how this might be achieved. This is to some extent dealt within File 2 of the Design & Technology Association’s Subject Leaders File, but more detailed advice would be helpful. This might include some information written specifically for the stakeholder groups that could be adapted to local circumstances.

It would also be useful if there were an easy to use feedback mechanism by which schools could inform the D&T Association of stakeholder response.

Recommendations to the D&TA

- Provide information materials, aimed at the various stakeholder groups, that subject leaders can adapt and use.
- Provide a mechanism by which subject leaders can feed the responses of stakeholders back to the Association.

Teacher trainers and CPD providers

The ITE landscape has changed considerably in recent years and it is important that the D&T Association finds ways to understand that landscape in all its variety – including SCITTs, School Direct, Teach First, Teaching School Alliances, Academy Chains and HEIs – and identify points of contact that enable influence. It is particularly important that all ITE providers deliver a consistent message concerning epistemology and purpose.

We believe that the above builds into a case for the D&T Association to develop training materials that cover the key messages in this paper and that ITE and CPD providers of all stripes can be encouraged to use to inform their work in design & technology.

Noting that the funding implications of what follows are not insignificant, we think that an invitation conference, bringing together as many design & technology ITE and CPD providers as possible, would provide an excellent opportunity to share and discuss the messages in this paper and explore ways of...
building them into professional development programmes at all levels. Awarding organisations (see below) as significant providers of CPD should also be included.

**Recommendations to the D&TA**

- Develop training materials for design & technology ITE and CPD providers covering the key messages in this paper.
- Organise an invitation conference for these ITE and CPD providers to discuss and disseminate the materials.

**Government, OfSTED and the awarding and assessment organisations**

The D&T Association has, we believe, established good contacts within the DfE, OfSTED and the awarding organisations. However impoverished understandings of the nature of design & technology and its purposes in the curriculum seem to be very hard to shift in these very organisations whose attitudes to the subject are key to its success.

The challenge appears to be to develop the capacity to achieve a much more proactive stance that enables the D&T Association to inform and contribute to policy at the earliest stages. The recent revision of the KS3 National Curriculum and the development of a new GCSE provide a model for how the D&T Association can wield its influence to great effect. To build on this it would be useful for the design & technology community and its supporters to develop suggestions for action or change that are consistent with the D&T Association’s vision for the subject and which are likely to gain a positive reception from Government, for example by indicating solutions to issues that the DfE is actively working on.

Given the significant influence that GCSE content and assessment has on subject practice, it would be helpful to ensure that the Chief Examiners for design & technology in the various awarding bodies, along with their colleagues, were to be brought into this conversation about design & technology epistemology and purpose; the suggested invitation conference (see above) should include these people.

**Recommendation to the D&TA**

- Encourage the design & technology community and its supporters to develop suggestions for action or change which are likely to gain a positive reception from Government.
Industry, employers and professional bodies
These are perhaps the most difficult of the stakeholder groups to influence, given that they inevitably have wide-ranging perspectives but also an instinctive view of the subject of design & technology which means that their arguments in support of it are almost always entirely economic.

We have argued above that embracing the wider arguments for including design & technology in the curriculum (including the social, personal and cultural) should lead to more pupils engaging with the subject at GCSE and thus provide a larger population of young people with a good understanding of designing, making and technology from which future employees can be drawn. This is a case that needs to made robustly to industry and employers. (The corollary of this argument is that focussing exclusively on the economic argument is, perversely, leading to a decline in the subject and thus a shrinking of this informed population.)

We suggest that since there is a well identified group of those who have already indicated their positive attitudes towards design & technology in the various campaigns of the D&T Association, it would be reasonably easy to persuade them, or a panel drawn from that group, that this broader vision for design & technology still aligns with their interests while making the subject much more robust for the longer term. Once this core group can publish a statement of rationale and support for both the epistemological underpinnings and the broad purposes of design & technology then this can be used as a platform to persuade others.

Recommendation to the D&TA
• With key partners from industry and the professions, develop a statement of support for design & technology that clearly defines both the epistemological underpinnings and the broad purposes of design & technology education.
• Use this rationale as a platform to persuade others to be active in support of design & technology as a school subject.

More pupils engaging with the subject at GCSE will provide a larger population of young people with a good understanding from which future employees can be drawn.
A final thought: Wise men and women

We suggest that an advisory body composed of influential thinkers including academics, consultants, industrialists, politicians, civil servants and head teachers be convened. These would be drawn from both inside and outside of the design & technology education community. Meeting once a year their remit would be to explore and examine the issues affecting design & technology in schools and to report in the form of strategic advice to the D&TA and the wider design & technology education community. They would be focussed on achieving informed stakeholder insight and recommending actions aimed at improving the position of design & technology in schools.

Recommendation to the D&TA

- Convene an advisory body to explore and examine the issues affecting design & technology in schools from a wide perspective and to report annually in the form of strategic advice.
Recommendations

In this paper, we have made several recommendations to the Design & Technology Association which are gathered together here.

The emphasis in these recommendations is on the leadership role of the Association; we are not suggesting in any way that the Association can undertake the role of re-building design & technology alone. All members of the community of practice along with those who support the subject of design & technology and those in positions of influence over the subject need to understand the key roles of Epistemology, Clarity of purpose, Good practice and Informed stakeholder perception in re-building design & technology as a key part of the school curriculum. All need to work with and in support of the Association in this endeavour.

Recommendations to the Design & Technology Association

1. Establish an agreed orthodoxy regarding the knowledge, understanding, skills and values for school design & technology.
2. Marshall support for a broader view of the purposes of school design & technology to include personal, social and cultural as well as economic aims.
3. Promote and provide CPD that meets the research criteria for effectiveness.
4. Establish financial support for effective CPD.
5. Provide information materials, aimed at the various stakeholder groups, that subject leaders can adapt and use.
6. Provide a mechanism by which subject leaders can feed the responses of stakeholders back to the Association.
7. Develop training materials for design & technology ITE and CPD providers covering the key messages in this paper.
8. Organise an invitation conference for these ITE and CPD providers to discuss and disseminate the materials.
9. Encourage the design & technology community and its supporters to develop suggestions for action or change which are likely to gain a positive reception from Government.
10. With key partners from industry and the professions, develop a statement of support for design & technology that clearly defines both the epistemological underpinnings and the broad purposes of design & technology education.
11. Use this rationale as a platform to persuade others to be active in support of design & technology as a school subject.
12. Convene an advisory body to explore and examine the issues affecting design & technology in schools from a wide perspective and to report annually in the form of strategic advice.
References


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D&TforD&T

David and Torben have been working together in design & technology education, on and off, for around 20 years. D&TforD&T is a means to enable us to disseminate our work and communicate with the design & technology community and its main vehicle is the D&TforD&T website. This allows us to bring together in a single place the things we are working on and thinking about, both together and individually.

The website also profiles associates with whom we frequently work – Nick is a key member of this group.

In particular, by doing some of our work and thinking more publicly we hope to draw in other colleagues from the D&T education community.

The core things we use the website for include:

- **Blogging:** to share our thoughts on various things in the broad areas of D&T and education as well as drawing attention to interesting things we find elsewhere on the web.
- **Noting courses and other CPD activities such as network meetings that we are involved in running.** We also mention other events, such as conferences, that we might be either speaking at or planning to attend.
- **Making available resources we have developed for teachers and/or pupils.** We also use this part of the website to share our plans for resource development and seek both commentary on these plans and support for the development work – such as help with trialling.
- **Discussion around and publicity for other projects we are involved in.**
- **Sharing the reading we are doing.** We have found, over the years, that discussing and sharing our reading has been an important route to developing and keeping fresh our thinking about D&T and education as well as helping us keep (each other) current with new developments. We want to share this reading and thinking more widely by noting the books, papers, reports and articles that are stimulating us.

https://dandtfordandt.wordpress.com