All you wanted to know about D&T but were afraid to ask?

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ABSTRACT

Torben Steeg and Hilda Beaumont have written a short book for design & technology teachers both in England and abroad; to support heads of department in particular although we expect the book to be useful to teachers in training. The publisher is Routledge, and the title is *Design and Technology in your School: Principles for Curriculum, Pedagogy and Assessment*. In writing this book we have called on the expertise of those who have significantly influenced the developing nature of the subject by inviting them to be critical friends of our writing and in some cases by contributing short pieces themselves. As a result, the content was not restricted to the thoughts of Torben and Hilda but was able to include voices from across the community of practice. This paper will describe our reasons for writing the book, the structure of the book, the devices used to support active engagement with the text, the contribution of critical friends and Thought Pieces, and the dealing with contentious issues. In the Concluding Remarks the paper discusses the place of the book in subject's current state of uncertainty.

Key Words: Curriculum, Pedagogy, Assessment, Design & Technology

1. INTRODUCTION

This paper describes the authors' approach to writing the book *Design and Technology in your School: Principles for Curriculum, Pedagogy and Assessment.* It is a short book for design & technology teachers in secondary schools (for learners aged 11 – 16 years) both in England and abroad. It is designed to support heads of department in particular although we expect the book to be useful to teachers in training. The publisher is Routledge. The paper is in seven parts. Part 1 outline our reasons for writing the book. Part 2 describes the structure of the book; Part 3 describes devices to support active engagement with the text and Part 4 the contribution of critical friends who commented on our writing as we developed the book. Part 5 describes the Thought Pieces written by experts in particular aspects of design & technology education. Part 6 discusses the way the book deals with contentious issues. The final part presents concluding remarks concerned with the uncertain future of the subject and how the book might be used.

2. OUR REASONS FOR WRITING THE BOOK

The situation with regard to design & technology is undoubtedly uncertain. Some see the subject as broken citing the continuing decline in uptake at GCSE level for over 20 years and recent changes to both the National Curriculum and GCSE Specifications. These changes, they argue, have led to a subject that is too demanding for those young people who used to enjoy studying it. The Design & Technology Association believe that it can be mended. Others are arguing that nothing less than the introduction of an alternative subject can save this important area of the curriculum. We think that it is important to have a clear statement of how a curriculum for design & technology, as originally conceived for the National Curriculum in England, can be successfully constructed, taught and assessed and to identify the support required for this to happen. Hence, we have written this book.

3. BASIC STRUCTURE

The overall structure if the book is shown in Table 1.1 which lists the chapters and the main sections within each chapter. To some extent these are what one might expect, the usual suspects: justifying, understanding, planning, teaching, and assessing but we also added two more chapters. One discusses issues that are of particular relevance at the time of writing. Recently there has been debate about the white washing of curricula (Akala 2019) and the way in which the curriculum is gendered (Unstereotype Alliance). Clearly the impact of global warming and pollution are matters of current concern. And the authors have long held the view that the way certain technologies play out in society by being disruptive is insufficiently acknowledged in the design & technology curriculum. The other describes ways in which design & technology may be supported which the authors feel is particularly important at this time when the subject is under threat.

Table 1.
Book structure

Chapter 1 **Justifying design & technology**	**Chapter 5** **Teaching design & technology**
Design & technology's role in the curriculum Four possible justifications Revisiting the role of design & technology in the curriculum	How learning happens Teaching technical understanding Teaching Making Teaching designing Teaching critique Digital Designing and Making
Chapter 2 **Understanding design & technology**	**Chapter 6** **Assessing design & technology**
Philosophy of technology Philosophy of design The place of values in design & technology Substantive and Disciplinary Knowledge in Design & Technology The place of skills, knowledge, understanding and values in intervening Relationships with other subjects	Purposes of assessment The messy nature of progress Integration of assessment into curriculum planning and implementation Feedback as part of "In the moment" assessment Feedback as part of "End of task" assessment

	Identifying impact Public examinations
Chapter 3 **Important Issues**	**Chapter 7** **Supporting design & technology**
Decolonising D&T Gender Disruption Global Warming Pollution and waste	Liaison with primary schools Enrichment & Enhancement Activities STEM and STEAM Research Continuing Professional Development Maker Education Interested parties Vision and Mission statements for design & technology
Chapter 4 **Planning your design & technology curriculum**	
Content Resources Activities Organisation and strategy Ofsted	

We must make it plain from the outset that we have not considered the place of food as part of design & technology within this book. There are several reasons for this. The place of food within National Curriculum design & technology has been marginalised by the insertion of a section at each key stage devoted to cooking and nutrition (Department for Education 2013). Food as a material to be used in design & technology was removed from all GCSE design & technology specifications in 2016 and GCSE Food Preparation and Nutrition was introduced at the same time (Department for Education 2015). Hilda has written separately about the teaching and learning of food technology in *Food futures in education and society* (Singh, Turner, & Rutland, 2023).

4. DEVICES TO SUPPORT ACTIVE ENGAGEMENT WITH THE TEXT

All chapters include Pauses for Thought. These are designed to stimulate the reader to think about what has just been read before moving on. Some of the Pauses for Thought ask questions of the reader to encourage individual reflection but many suggest questions that might be discussed with colleagues as a means of building collaboration and collegiality which both of us believe are important for developing a voice for design & technology that is articulate and taken into account by colleagues from other subjects and senior leaders. In addition to Pauses for Thought Chapter 2 also contains a series of Curriculum Considerations each related to a specific part of that chapter. This are summarised in Table 1.2. These are to encourage teachers to develop aspects of the curriculum that they may have, in the past, neglected. Our view is that any curriculum should be seen as dynamic in that it will have embedded within it conflicting requirements that can only be addressed by those teaching it on an on-going basis.

Table 2
Curriculum Considerations

Area of considerations	Features to consider
Concerning Carl Mitcham's thinking about the philosophy of technology	Engaging young people with a) the sort of artefacts they should design and make, b) the knowledge they will need to discover, c) the sort of activities they should pursue and d) the extent to which volition should be tempered
Concerning the philosophy of design	The feasibility of meeting a wide range of criteria for any item learners design and make. The idea of community design as exemplified in approaches to design taken in developing countries in contrast to the prevailing western view of designer as 'individual hero'. The importance of challenging the idea of a linear economy with circular economy ideas
Concerning values	Developing a vocabulary for values thinking Enabling progression in values thinking Engaging in the politics of values thinking
Concerning substantive and disciplinary knowledge	Managing the balance between talking about important issues and responding through practical activity in the classroom The difficulties associated with assessing learners' value positions Managing open starting points for design activity
Concerning relationships with other subjects	That design & technology and other subjects might benefit from thinking about the ways each other assess learners' progress The importance of maintaining subject integrity Identifying links that are of mutual benefit

THE CONTRIBUTION OF CRITICAL FRIENDS

We relied on several members of the design & technology community of practice to comment on our writing as we developed the book. They responded with generosity and insight and the result is significantly better because of their comments. Hence, we are grateful to the critical friends listed in Table 1.3 along with the sections they commented on, but we must add that we take responsibility for the text that appears in the book.

Table 3
Critical friends

Critical friend	Commented on
Nick Givens Senior Lecturer, College of Social Sciences and International Studies University of Exeter (retired) Associate at University of Exeter	Decolonising design & technology Global Warming
Jonas Hallström Professor of Technology Education, Technology and Science Education Research Linkoping University	Philosophy of technology
Mary Myatt Education adviser, writer and speaker	Substantive and disciplinary knowledge
Mike Martin School of Education, Liverpool John Moores University	Values in design & technology
Kay Stables Professor of Design Education Goldsmiths, University of London	Philosophy of design

5. THE THOUGHT PIECE CONTRIBUTIONS

We have deliberately written a short book and are conscious that this is a mixed blessing. On the one hand the shortness required us to write in a disciplined and focussed way, making key ideas easier to access but on the other hand there is the possibility that we had not given sufficient consideration to some of the key ideas. To mitigate this, we asked other authors, who are experts in particular aspects of design & technology education, to write 'Thought Pieces' in which they make further comment on a key idea. In this way we hoped that the expertise of the wider design & technology education community would inform the book. We were not disappointed. The following gave unstintingly of their time, experience and thoughtfulness in contributing Thought Pieces that make significant additions.

(i) Louise Attwood Head of Curriculum – Design & Technology for the Awarding Organisation AQA
(ii) Ed Charlwood Expert teacher of engineering and design & technology and educational consultant regarding curriculum and pedagogy
(iii) Dr Alison Hardy Associate Professor, writer, researcher, and podcaster at Nottingham Trent University
(iv) Philip Holton Senior Strategy Manager for Pearson UK Schools
(v) Dr Dawne Irving Bell Professor of Learning and Teaching at BPP University.
(vi) Richard Kimbell Emeritus Professor, Goldsmiths University of London.
(vii) Dr Matt McLain School of Education, Liverpool John Moores University
(viii) Dr Paul Mburu Head of Design & Technology Department, Harlington School
(ix) Andy Mitchell Ex Deputy CEO The Design and Technology Association
(x) Dominic Nolan Corporate Social Responsibility Leader, Kyndryl UK & Ireland
(xi) James Pitt Honorary Professor of Education at the Amur State University of Humanities and Pedagogy, Russia
(xii) Ulrika Sultan Educator, and researcher at Örebro University
(xiii) Dr Malcolm Welch Professor Emeritus at Queen's University, Kingston, Ontario

The main thrusts of the Thought Pieces are summarised in Table 1.4. These are clearly relevant to the content of the particular chapters and while one could argue that we could have included this in our own writing we feel that engaging others to do this gives rise to additional and different thoughts which have an added status and prominence. Also, we were able to write a short response to each of the Thought Pieces starting with the phrase, "What are we to make of …" which further increase the contributions made by the Thought Piece authors.

Table.4
Thought Pieces

Author of Thought Piece	Topic of the Thought Piece	Main thrust of the Thought Piece
Alison Hardy In Chapter 1	Justifying design & technology	Alison argued that in justifying design & technology we need to match arguments to the positions of the

		stakeholders we are trying to convince of its worth and widen the discussion to include learners.
Andy Mitchell In Chapter 2	Starting points in design & technology	Andy argued that in using open tasks to enable creativity and learner ownership it was important to teach relevant substantive and disciplinary knowledge. He noted that whilst in some cases it was important for learners to design AND make outcomes in response to the task, he could justify learners developing design proposals which they did not make. In developing proposals that learners did not make it was possible for them to engage with global problems.
Ulrika Sultan In Chapter 3	Gender for design & technology teachers	Ulrika challenged the prevailing binary position that most adopt in western society categorising learners as boys or girls as opposed to treating them as individuals with their own preferences with regard to interests, attitudes and aspirations. She acknowledges the pressure on learners to conform to gender stereotypes but argued that we should help them resist this and a first step here is for teachers to challenge such stereotypes themselves.
Dominic Nolan In Chapter 3	Global Warming for Design & Technology teachers	Dominic makes a strong case for organisations developing their own carbon literacy education programmes in that they not only inform about global warming issues but, crucially, empower people to respond in ways that make a difference and challenge the selfishness, greed, and apathy that bedevils attempts towards net zero.
Philip Holton In Chapter 4	Physical Resources as a legacy approach	Phil argues for learners to produce proof of concept models in response to a design brief as opposed to a high quality final prototype suggesting that this is the way professional designers work. To accommodate this, he outlines an approach to learning in KS3 that utilises simple tools and materials but enable learners to make connections between the tools and materials that might be used to produce a more physically robust outcome. This removes the subject from the dead hand of past requirements of craft practice.
Paul Mburu In Chapter 4	Developing teams as a key leadership strategy	Paul makes a strong case for a team approach to the way a design & technology department develop and implement their curriculum. He underpins this with the importance of creating an environment where the sharing of good practice is seen as developmental rather than judgemental and members of staff draw upon experiences gained through working in a variety of teaching and planning teams. In his view this will lead to significant individual professional development and improvement of the department in the long term.
Matt McLain In Chapter 5	Demonstration; a pedagogy for teaching	Matt makes the case for learners acquiring a limited set of useful making skills through demonstration and practice as a gateway to developing designing skills. With this approach they design what they can make as opposed to developing high levels of practical craft skill in a narrow disciplinary area as an end goal.
James Pitt In Chapter 5	Some wider considerations	James argues that through critique, design & technology can play its part in contributing to

		liberating education and help young people develop a vision of a future worth wanting and the abilities to achieve this. Critiquing products, systems and technologies he suggests are central to design & technology learning. This suggestion can be used as a vehicle for encouraging radical thinking. It can be an antidote to mindless populism, uncritical consumption, and echo-chamber prejudice.
Ed Charlwood In Chapter 5	Moving forward with digital design & technology	Ed argues for the use of digital tools as the means to increase learners' agency. Not only in their ability to be creative in conceiving innovative designs through CAD but also in realising those designs through CAM. He realises that this will involve many teachers rethinking long held and cherished beliefs about the importance of craft practice but is firm in his opinion that digital designing and making should become a core feature of design & technology alongside the use of physical materials and components in exploring design ideas.
Malcolm Welch In Chapter 6	Classroom conversations	Malcolm explores the role of talking in the design & technology workshop as a means of helping learners develop the conceptual understanding to make sound design decisions. A key feature of such conversations was the way that teachers use questions in response to learner's questions to help learners progress their thinking as opposed to telling learners the answers. This approach requires learners to think more deeply and hence achieve the cognitive shifts required for understanding.
Richard Kimbell In Chapter 6	All assessment judgements are comparative	Richard makes the case for assessment to be carried out by means of comparative judgements by which it is possible to develop a rank order of learner performance. This he claims is more valid and more reliable than attempting to match learner's performance to criteria statements linked to numerical scores which are then used to give learners a 'mark' from which a grade is then awarded. Richard laments the fact that the examination system adopts the performance criteria approach when a properly workable system of direct comparative judgment had been developed a decade ago at Goldsmiths University.
Louise Attwood In Chapter 6	Valid assessment: grades and marks	Louise describes in some detail the approaches that AQA use to assess learner's GCSE performance which she argues includes to some extent the comparative pairs approach advocated by Richard Kimbell. She also describes how awarding organisations are required to use statistical information to ensure comparability of standards between years and prevent grade inflation and she acknowledges the importance of teacher professional judgement throughout the process.
Dawne Irving Bell In Chapter 7	Support for Curriculum Collaboration	In discussing how teachers might respond to STEM and STEAM initiatives Dawne advocates the forging of strong relationships across the curriculum both within teachers' own schools and between different

		schools citing design fiction (very similar to designing without making) as a learning activity suitable for collaboration. She views this as an important strategy to enable learners to challenge technological determinism in the identification and pursuit of a future worth wanting.

6. DEALING WITH CONTENTIOUS ISSUES

We identified five areas which we considered to be contentious issues:

6.1. Decolonising design & technology

A key question for us in considering decolonising our subject was, 'How might a design & technology curriculum enhance or diminish the engagement and success of learners from minoritized backgrounds?" To enhance engagement, we believed it was essential that all learners 'felt at home' within the design & technology curriculum echoing the point made by Maya Angelou in All God's children need travelling shoes (1987) that home was a safe place where we can go as we are and not be questioned. This led us to affirm the importance of the visibility in the curriculum of those from minoritized backgrounds who had been, and are being, successful in design & technology related fields of endeavour and as part of this to challenge the Europe - centred colonial lens which paints a whitewashed retelling of the history of empire that speaks only to its "successes," whilst omitting its evils, the voices of the oppressed and the lasting legacy of imperialism today.

6.2 Gender in design & technology

In Chapter 1 we identified four justifications for teaching all young people design & technology: personal empowerment, preparation for citizenship, cultural transmission, and preparation for work, particularly in STEM occupations. Our position is that each of these justifications are equally appropriate for both boys and girls, but we find that this isn't always reflected in girls' career choices or society's expectations of how young women or young men should operate in the world. Challenging gender stereotypes is important, and we considered that it might be useful to introduce activities in ways that were gender sensitive such that both boys and girls are enabled to cross the gender stereotype divide.

6.3 Disruption

In developing technological perspective in young people, we thought it important that they were introduced to the ideas of certain technologies being disruptive in that they upset the status quo, alter the way people live and work, reorganise financial and social structures and lead to entirely new products and services (Manyika J et al, 2013). The authors, working with Nick Givens, have identified, and discussed 9 disruptive technologies they consider highly suitable for inclusion in the secondary school curriculum (Barlex, Givens and Steeg 2020) and have suggested in which areas of the curriculum they might best be taught. We identified three categories of disruption:

deliberate, incidental, and cultural. In the book the realities of disruption to everyday life were considered through the possible impact of the identified disruptive technologies on transport.

6.4 Global Warming

Although climate change denial is on the wane, we thought it important to present the evidence (MacKay 2009) and information about the Intergovernmental Panel on Climate Change (IPCC) and details of their findings along with the predicted effects of global warming on climate and efforts of governments to adapt to and mitigate these effects including the outcomes of COP27. Concern over tipping points was discussed along with the importance of climate justice. The role of technologies in 'rescuing' the planet was considered including carbon capture, nuclear power, a hydrogen economy, and renewable energy sources. Possible personal responses to the issue were considered and how the these can inform national and international responses to the situation in the light of Gus Spence (Holtam 2022), Dean of the Yale School of Forestry and Environmental Studies comment:

> I used to think the top environmental problems were biodiversity loss, eco system collapse and climate change. I thought that with 30 years of good science we could address these problems. But I was wrong. The top environmental problems are selfishness, greed, and apathy – and to deal with those we need a spiritual and cultural transformation – and we scientists don't know how to do that.

6.5 Pollution and waste

Here the focus was on developing a circular economy identifying its three key principles: eliminating waste and pollution, circulating products and materials at their highest value, and regenerating nature. The biological and technical cycle comprising a circular economy were discussed in some depth and exemplified using case studies. The following three important ideas that learners need to be taught if they are to understand the idea of a circular economy were identified: systems thinking (which can be used in designing for circularity to minimise waste), life cycle analysis and designing for sharing or leasing as opposed to selling which challenges the idea of personal ownership.

7 CONCLUDING REMARKS

We have noted that the situation with regard to design & technology is uncertain. The Design & Technology Association believe that the subject can be reinstated through modification and in the final chapter *Supporting design & technology* there are links to the recommendations made in the Design & Technology Associations *Reimagining D&T Report* (Design & Technology Associations 2023). Others, for example Philip Holton at Pearsons, argue that nothing less than the introduction of an alternative subject can save this important area of the curriculum. Hence, he is spearheading efforts in collaboration with the Department for Education to introduce a new subject to be called *Responsible design & innovation* at both KS3 and KS4. This is not without its critics, but it is providing a useful forum for discussing future developments. The teaching of the subject, in whatever guise, needs to be responsive to current events in the world outside

school. To emphasise this, we have included two Stop Press items of particular relevance at the time of going to press: one concerning recent developments in AI focusing on the use of the Chatbot ChatGPT in developing responses to design briefs and one concerning recent comments from the Climate Change Committee criticising the way the UK government is putting in place the means to adapt to the impact of climate change. However the development of the subject plays out we believe that our book *Design and Technology in your School: Principles for Curriculum, Pedagogy and Assessment* will be of use to teachers and heads of department in the coming years. With this in mind we will be developing additional and associated web based resources on our web site (https://dandtfordandt.wordpress.com) and are planning to work with those departments who wish to use the book and its associated resources for curriculum and professional development.

8 REFERENCES

Akala (2019) *Natives Race and Class in the Ruins of Empire*. UK: Two Roads

Angelou, M. (1987 *All God's children need travelling shoes*. London,:Virago.

Barlex, D., Givens, N. and and Steeg, T. (2021) Teaching about disruption: A key feature of new and emerging technologies in Hardy, A (ed) *Learning to teach design and technology in the secondary school* 4th Edition. Oxon; `Routledge

Department for Education (2013) The statutory programmes of study and attainment targets for design and technology at key stages 1 to 3. Available at this url: https://www.gov.uk/government/publications/national-curriculum-in-england-design-and-technology-programmes-of-study Accessed 25 June 2023

Department for Education (2015) GCSE Food Preparation and Nutrition. Available at this url:

https://www.gov.uk/government/publications/gcse-food-preparation-and-nutrition Accessed 25 June 2023

Design & Technology Associations (2023) Reimagining D&T Report. Available at this url: https://www.designtechnology.org.uk/campaigns/reimagining-design-and-technology/ Accessed 25 June 2023

Holtam, N. (2022) *Sleepers Wake Getting serious about climate change.* London: SPCK

MacKay, David J C (2009) *Sustainable Energy without the hot air*. Cambridge,:UIT Cambridge

Available free to download at www.withouthotair.com

Manyika J et al (2013) *Disruptive technologies: Advances that will transform life, business, and the global economy* McKinsey Global Institute. Available at this url: https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/disruptive-technologies Accessed 20 May 2022

Singh, G., Turner, A. & Rutland, M. (eds) 2023. *Food Futures in Education and Society*. Oxford: Routledge

Unstereotype Alliance See https://www.unstereotypealliance.org/en/about Accessed 30.08.2023