

## Review

### Mastering Primary Design and Technology

Author: **Gill Hope**

**Publisher:** Bloomsbury Academic, London

**Series:** Mastering Primary Teaching Series

**Series Editors:** Judith Roden and James Archer

**Publication:** 2018

**Reviewer:** Wendy Fox-Turnbull, University of Waikato, Hamilton, New Zealand

### Introduction

It is refreshing to read a book devoted to teaching Design and Technology in the primary classroom. I was hooked as soon as I read in the introduction when author Gill Hope stated that she was using the full term 'Design and Technology' throughout the book and not abbreviated to 'D&T' or 'dt'. Her reasons "the danger of using such abbreviations is in forgetting what they stand for" (p2). I agree with this whole heartedly as I think it is very important to emphasise the design component of Design and Technology Education as this distinguishes this curriculum area from classes that involve "just making stuff".

First introduced into the national curriculum in 1990 in England and Wales Design and Technology known elsewhere as Technology Education or Technology and Engineering Education has been implemented around the world for children from aged 3-13 (Benson & Lunt, 2011). However, in recent years technology has found itself competing for time in both the primary classroom and in initial teacher education programmes. For example, in New Zealand Technology Education (Design and Technology) the primary classroom along with science and social children among others has taken a back seat due to a significant focus on literacy and numeracy and the implementation of national standards in reading writing and numeracy by the previous government nine years ago. Declining hours available to student teachers' instruction time in Design and Technology education has also contributed to the limited classroom experiences in Design and Technology for many primary children before they enter secondary school (Forret et al., 2011). This has means that many secondary teachers struggle to attract children to their discipline because children do not understand what it is, or they have had experiences labelled as technology, which in fact were merely making activities. Those who are attracted have considerable catch-up to do to ensure they are ready for senior secondary assessment and examinations within two to three years of beginning high school.

It is therefore useful to have this book dedicated to the teaching of primary Design and Technology and although written the English context I have found it very relevant to my own New Zealand context. The book offers a range of features within each chapter to inform and engage the reader in critical thinking about implementation of Design and Technology. Features include: a chapter overview, case studies, places to pause and reflect on chapter content, examples of children's work and relevant excerpts from policy documents. Most are applicable internationally and well as in England and Wales. In this review I begin with an overview of the book and then review each chapter in more detail.

### **Book Overview**

The early sections of the book include a contents page, a list of figures and a list of tables to guide the reader through the book. The List of Tables is followed by a foreword by the series editors Judith Roden and James Archer who begin with the identification of two main target audiences for the series, both beginner and experience teachers. They identify aims of the series including to introduce current and contemporary practices within each curriculum area. They also hope to equip student teachers and beginning teachers with enough understanding and knowledge to achieve mastery in the curriculum areas. The series editors' foreword is followed by a 'How to Use this Book' section also written by the Roden and Archer and which, concludes with an introduction to the author. Following a subsequent Acknowledgements section, the Introduction offers a chapter synopsis and a rationale for the exclusion of Early Years Design and Technology from the book, which does cover from children five years and older. A Glossary on p.6 defines several terms related to Design and Technology that are often misunderstood or have multiple meanings in the wider world such as technology and model (both noun and verb). The book comprises of eight further chapters, each outlined below.

### **Chapter Outlines**

The eight chapters of the book use the same format. Each begins with a list of bullet-pointed chapter objectives giving useful insight into what is coming. Throughout each chapter, there are opportunities to reflect on what the author is saying and suggests the reader consider implications for their own lives. Several case studies throughout the book exemplify key ideas the author is making. Chapters conclude with a summary and a list of recommended readings.

### **Chapter 1: An Introduction to Primary Design and Technology**

This chapter introduces the reader to Design and Technology. The chapter synopsis states that the chapter leads to consideration about the importance and relevance of technology education. The chapter begins by placing technology at the heart of what it is to be human. This is an excellent place to start when considering technology. It is vitally important to recognise that making things and changing the world around us are innate human activities, and thus warrant considerable study. The first 'Pause for thought' section encourages the reader to focus on their personal relationship with technology, technology's relationship to science and any experiences of design

and technology at school. The chapter continues with a definition of technology as “basically everything designed and made by humans” (p11). This definition has a strong focus on artefacts and systems related to feeding ourselves, keeping warm, movement, and defence. The definition is somewhat narrower than the four aspects Dakers (2017) discusses in Springer 2017 International Handbook of Technology. As well as the artefacts and systems developed by humans Dakers, drawing on Carl Mitcham’s work, suggests technology is knowledge, different from science, to be studied and learned. He also suggests that technology is developed processes, the actual designing and making processes developed. The fourth aspect relates to the social value of technology and including ethical and environmental considerations. Some aspects of the latter are hinted at by Hope as she talks about human impact on the planet and the role technology has played in this. Further discussion distinguishes technology from art, with an emphasis on the purposeful intervention of technology. England and Wales Design and Technology Associations’ “Star Diagram” reminds us of six aspects involved in designing and making, number of which offer a distinction from Art. Unfortunately, the URL given for locating the star diagram was inaccessible on the D&T website.

The chapter continues by offering a strong education-based rationale for teaching technology and infers the ubiquity of technology and the skills and abilities necessary for design and development of successful products such as: it offers satisfaction, develops self-confidence and higher-level thinking as well as empathy and understanding of other people’s needs and wants. It is refreshing to see an education-based rationale for technology implementation in the curriculum rather than a fiscal, economic or political rationale often seen. The final section of the chapter enhances the rationale by outlining further learning and developmental benefits for children by adding to their sense of agency and well-being. I particularly appreciated the ‘State of Flow’ or deep connection reference (Csikszentmihalyi, 1990), as this is a connection I too have made to children’s involvement in technology although originally identified in a physical context of playing sport.

## **Chapter 2: Current Development in Design and Technology**

Chapter 2 offers insight into current development in design and technology within the English context and begins by offering a brief history of Design and Technology in England. Reflection into where a curriculum has come from is critical when undertaking development and change. Insight into past success and failures ensures against repeated mistakes, and that curriculum design is forward facing. The current state of technology in primary schools is then given with reference to Ofsted reports from 2008 and 2016. This comparison offers insight backward progress in terms of children’s engagement in design in favour of making “successful products”. This appears to reflect the product-based nature of the curriculum or perhaps the perceived success of product development as opposed to additional value given to processes, knowledge and ethical considerations developed when designing is a strong component of the curriculum.

The penultimate section of the chapter offers insight into potential areas of integration across a range of other curriculum learning areas (subjects). Integration offers several benefits for both teachers and children. An integrated programme is more time efficient, activities and learning are assessed from multiple perspectives and engagement and motivation are high as learning is authentic and contextually based. There is one danger of integration that is worth consideration and exploration in this text. This is what I call “Mucky Brown Paint Syndrome” (Fox-Turnbull, 2012b) and indicates that busy engaged children are not always learning key concepts and ideas in each of the applicable learning areas, indeed sometimes they are not even aware of subject content or concepts they are meant to be learning.

The chapter’s final section compares Design and Technology in England to that of other English-speaking nations such as: New Zealand, Malta and South Africa who offer a number of similarities, especially an emphasis in design. I too can see several similarities to technology in the New Zealand curriculum such as a strong emphasis on design and modelling design ideas. There are however a number of significant differences the main one of which is a focus in the New Zealand technology curriculum on the nature of technology and identification of technological knowledge unique to the discipline (Ministry of Education, 2007). These two aspects make up a significant portion of the curriculum through the delivery of two strands of learning by the same names: ‘Technological Knowledge’ and ‘The Nature of Technology’.

### **Chapter 3: Design and Technology as an Irresistible Activity**

An error in the second paragraph of the Chapter Synopses on p.2 attributes current development and national comparisons to this chapter, when in fact they all belong in Chapter 2 as mentioned above. The third paragraph of the Synopses correctly identifies that Chapter 3 discusses what it is about technology that is so engaging for children. This section rightly attributes a large range of key ideas to primary children’s engagement in technology. These include the hands-on nature of the activity, that students can see real progress in terms of tangible outcomes and that it allows them choice, trial and error encompassing the evaluation of their actions. This thinking certainly aligns with my experiences of teaching technology in primary school. Another related benefit I always enjoy making explicit to children and the student teachers with whom I now work is that in technology mistakes are “cool” and something to celebrate and learned from. Students are often unaware of the “work” they are doing in technology. The play-based nature of the tasks certainly assists with engagement. Other benefits mentioned in the chapter are the improvement of the physical and kinetic skills, development of higher-level thinking, social skills such as collaborating, compromising and negotiating and numerous specific skills “borrowed” for other learning areas such as writing, measuring, drawing, understand the relationship of forces and materials as well as confrontation with various moral and ethical issues.

The second section of the chapter deals with the iterative nature the technological process from early design ideas through to final product development. It presents a number of well-known models of technology practice, related to the need for design theory to augment creatively to

ensure a worthwhile technological outcome. Of particular value are Middleton's 'problem zone' which illustrates the potentially chaotic nature of designing and Kimbell's APU model which emphasises the iterative nature of designing as well as balance between cognitive and physical activity. The chapter concludes with a number of "classroom stories" which clearly illustrate key points made throughout the chapter.

#### **Chapter 4: Design and Technology as a Practical Activity**

Chapter 3 provides examples of the types of activities done in the primary classroom that constitute technological activity. This chapter offers useful guidance for teachers thinking about teaching technology. It identifies considerations teachers need to make when identifying potential products to be designed. Usefully it also defines 'product'. I note that this chapter has a heavy focus on products. In New Zealand, as well as others, students are encouraged and taught to design systems as well as products as both make up our "designed world". The chapter is well-illustrated with a range of actual examples of students' work in technology from all five areas of technology: structures, mechanisms, electrical control, textiles and food. I suggest that the area of electrical control does involve the use of electrical systems, however very little is mentioned about inputs and related outputs nor the design of the system, but rather using an electrical system to develop a product.

#### **Chapter 5 Skills to Develop in Design and Technology**

The main skills discussed in Chapter 5 include aspects of procedural knowledge. These include designing for others, modelling and reflective activity. The chapter begins with a rationale for the inclusion of procedural knowledge in Design and technology. This supports McCormick's (1997) who identify that both procedural and conceptual knowledge is critical to technology practice and Jones and Moreland (2001) who also identify procedural and conceptual knowledge, as well as technical and societal knowledge as key components of technology practice.

Six skills identified as necessary when students are working with users include: need identification, evaluation of existing designs, generation of ideas, communicating and accepting feedback, product making and evaluation of product and process. Usefully Hope emphasises that these are not a lesson-by-lesson account of what will happen, but merely emphasise the iterative nature of technology practice as outlined previously in Kimbell's APU model of technology practice.

Parkinson's '5 M' model used to classify underlying skills needed for successful technology practice is critiqued in the next section of this chapter. The five Ms stand for: Making, Modelling, Manipulating, Mending and Modifying. Jointly developed and published with colleague Parkinson, Hope offers a suggestion that perhaps the last four are indeed subsets of the first. Modelling, mending, manipulating and modifying are in fact all subsets of the process of making. I agree with this point and take this critique somewhat further by suggesting that 'manipulating' and 'mending' are likely to be subset of modelling, as indeed could 'modifying'. It is also important to recognise that adaptation is significantly different to modification and an equally important part of

technological practice. Alluded to in the chapter, however a clear distinction between the two might have been useful.

### **Chapter 6: Children's Ideas- Promoting Curiosity**

An aspect that is particularly relevant to technology education is that of promoting curiosity. I was delighted to find this chapter in the book. We often hear and read about the need for creativity in technology (Benson & Lawson, 2017). Often attributed to science education but rarely technology, curiosity is identified as a critical component of technology in this chapter. The balance between being curious about how the technological world works, creating functioning products and thinking creatively need careful balance. This chapter offers useful range of ideas to pique children's curiosity about the made-world. It also offers insight to ensure transfer of knowledge gained from investigations and queries to technology practice. I especially like the idea of product collections. Useful ideas provide guidance for the setting up of such collections. I know of several collections of technological artefacts owned by colleagues: potato peelers, children's jigsaw puzzles, scrubbing brushes to name a few, used to foster curiosity and critique about design and design features.

Another technique suggested to develop curiosity mentioned in Chapter 6 is the use of children's existing knowledge and experience to contribute to their understanding of the world. This aligns well with the idea that students come to school with 'Funds of Knowledge'(González, Moll, & Amanti, 2005) from their local community, family and culture that assist them in making sense of and contribute to school learning especially in technology (Fox-Turnbull, 2012a). Hope also suggests that prior school learning in technology and learning other curriculum areas also contributes to students' learning about the technological world. These ideas are supported and further explored in greater depth in my PhD thesis (Fox-Turnbull, 2013).

### **Chapter 7: Assessing Children in Design and Technology**

The taking a test or an examination in technology clashes with its underlying philosophy. Summative assessment has a limited role in technology, therefore it makes perfect sense that Chapter 7 focuses on assessment FOR learning or formative assessment of technology and begins with an explanation of formative assessment and the role self-assessment plays within it. The chapter then demonstrates how self-assessment can be undertaken within a technology context. The chapter concludes with a look at the Key Stages 1 and 2 Progression framework and how it is used for assessment of technology. The chapter closes with a mention of longer term planning and assessment and how several curriculum areas or subjects can be assessed within a technology project. The strong linking between formative assessment and technology is sound, as intimated above. However, I think the chapter could have been of more use to teachers if it had considered how learning intentions-the recognition of intended learning and success criteria-what success of the intended learning looks like had been included. The writing of context free learning intentions and specific success criteria assist teacher driven assessment and guide self and peer assessment (Clarke, 2008) and work particularly well in technology (Fox-Turnbull, 2012b).

## Chapter 8: Practical Issues

Finally, Chapter 8 looks at practical issues for implementing technology at a school-wide level. Because of its practical, hands on nature technology offers several challenges for schools as they implement it across all levels. Hope starts by considering the 'bare minimum' identified by the Design and Technology Associations' Expert Advisory Group for Primary Schools. Other very relevant aspects of consideration for schools discussed briefly are Health & Safety and Inclusion & Diversity. In technology, something as simple as being left-handed can significantly disadvantage a child as many practical tools are designed for right –handed people. It is useful to acknowledge that something as simple and common as this relates to student inclusion. This mention has the potential to trigger the identification of other areas of impact on students' wellbeing in technology.

The chapter concludes with a brief but useful discussion about developing personal professional knowledge in technology and the consideration of subject leadership. Ongoing professional development and leadership are significant and considerable issues in technology, especially in recent times when funding for professional development seems harder to get. More and more teachers are being asked to be responsible for their planning their own profession development and to take voluntary leadership roles to assist others in this journey. This offers a challenge to technology given that it is a relatively recent addition to national curriculum.

## Conclusion

This book offers an overview into several key ideas related to implementation of design and technology in the English and Welsh primary school. I expect it will be of greater interest to those who teach design and technology in these countries, however I found the book to be engaging and informative, with a format that lends itself as a text for student teachers and or teachers undertaking professional development in technology. It lays down a number of key foundational ideas and uses children's work to illustrate ideas as well as offering numerous opportunities for reflections and discussion.

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