4 How 'messiness' in Design and Technology can inspire creative teaching and learning

James Archer and Rachel Linfield

Critical questions

What is inspiring Design and Technology and what makes it distinctive as a subject in the primary curriculum?
How can Design and Technology inspire primary learners?
Where is the 'messiness' in primary Design and Technology and why is it important?

Introduction

Design and Technology has the potential to be an inspiring, rigorous and practical subject. Using creativity and imagination, pupils design and make products that solve real and relevant problems within a variety of contexts, considering their own and others' needs, wants and values; this chapter helps highlight how.

What is primary Design and Technology?

As primary practitioners, it is important that we look at our own perception of each of the subjects that make up the primary curriculum. Chambers (1983) started a research phenomenon asking primary aged children to draw what they thought a scientist and engineer looked like. Further research has indicated that we hold stereotypical perceptions in relation to who can be an engineer and what they do. At the outset of this chapter, we would like to invite you to consider what perceptions you may hold and how this could influence your practice in primary Design and Technology.

Critical questions and Personal reflections

- What is your earliest memory of Design and Technology?
- In what ways has what you have learnt in Design and Technology been useful?
- In your own words, how would you define primary Design and Technology?
- How do your experiences link and influence your definition of primary Design and Technology?

The following pictures illustrate views of 'what someone who is good at Design and Technology' might look like. Interestingly all the artists, before drawing, wanted further clarification. Matthew aged six asked what Design and Technology was. He then said "Oh I know. I'll draw Mr Sparks. He's good at maths too." Thomas aged eight asked "Can I draw me? I'm good at D and T!" Nate aged fifteen based his picture on his father, an expert in all DIY jobs with tools to suit all problems. Soaibha, a trainee

teacher, having experienced the subject at school and university decided to draw the lecturer who had taught the Design and Technology module. Rosie aged twenty-two felt Design and Technology happened throughout life. Her picture combined her father (the lab coat and mask), her mother (the tools) and appearance (the British Gas man who happened on the day of drawing to be solving problems whilst installing a gas boiler. The final picture by Kiera aged fifteen recognised that most Design and Technology required tools. She did not however feel there was 'a look for a D and T expert'.

The drawings indicate a move away from Chambers' research. They illustrate that a range of people can do Design and Technology. All participants, before drawing, wanted to talk and based their pictures on real people showing the importance of role models.

Matthew

Thomas

Nate

Soaibha

Rosie

Kiera

As reflective practitioners, we often discover that the way in which we educate is influenced by our own educational and personal experiences. Values are developed throughout our lives that go on to influence the way that we teach. You can probably remember your least favourite experience in primary Design and Technology and may well be able to identify times when you were praised and your confidence increased. Understanding the origins of teacher confidence and competence in primary Design and Technology is crucial if we are to appreciate fully the nature of primary Design and Technology.

Drawing can reveal our perceptions. By eliciting children's ideas about design and designers, as well as any other manner of concepts, we are provided with a useful platform on which new learning can be built.

Research/theory focus 1 – Teacher confidence and competence in Primary Design and Technology

The article below looks at the impact of the lived Design and Technology experience by the trainee teacher upon their future practice. Whilst the study focuses largely on secondary trainee participants the implications for those undertaking training in the primary sector are equally appropriate.

Read the following and consider how the findings might resonate with your own experience:
Bell, D. (2015). The reality of STEM education, design and technology teachers' perceptions: a phenomenographic study. *International Journal of Technology and Design Education*, 26(1), pp.61-79.

- **Critical question:**

The research concludes:

"Where a teacher's own knowledge and understanding is deficient, findings indicate the potential for pupil learning is limited."

(Bell, 2015, p.16)

In relation to this, what do you think the implications may be for your future education in Design and Technology?

The Programme of Study for Primary Design and Technology provides the following explanation for the subject's purpose:

> "Design and technology is an inspiring, rigorous and practical subject. Using creativity and imagination, pupils design and make products that solve real and relevant problems within a variety of contexts, considering their own and others' needs, wants and values. They acquire a broad range of subject knowledge and draw on disciplines such as mathematics, science, engineering, computing and art."
>
> (DFE, 2013, p.1)

This seems to imply Design and Technology might be seen as a little 'messy'. This messiness occurs because Design and Technology is an amalgam of a wide range of disciplines. Design and Technology being subject made out of a combination of subjects can provide scope in developing and fostering links with other disciplines. Understanding the constituent discipline elements that make up Design and Technology can help us develop a greater understanding of what Design and Technology is and what it is not. The following section will consider the impact of seeing Design and Technology as an art, and Design and Technology as a science.

Understanding what constitutes an Arts discipline is tricky as a there is very little agreement on a clear definition. All too often, there is a confusion with many people assuming that the arts must have visual and aesthetic qualities. The National Advisory Committee on Creative and Cultural Education (1999) developed a pervasive definition of creative arts education that still informs many people's understanding today. They suggest that a creative arts education is:

> "Imaginative activity fashioned so as to produce outcomes that are both original and of value"
>
> (NACCCE, 1999, p. 30)

Such a definition may well be the reason for the misunderstanding of what is involved in arts based disciplines. Simply reducing the arts to physical activity, that produces outcomes that are valued, in the way that the quote above advocates does not fully appreciate the levels of cognition that are involved in arts linked subjects such as Design and Technology.

Davies and Howe (2003) speak about Design and Technology being 'wicked' inferring that a great deal of creative thought is essential to addressing design problems. Design and Technology as an art is therefore much more to do with the thinking process rather than the embellishment of the end product. In addition, such a cognitive exercise may not always result in a tangible, physical form (for an example of design without the creation of a physical final product see Case Study 3).

The Case Study below explores the practices of two teachers. Which one do you think best represents a definition of Design and Technology as an art?

Art or Design and Technology? – case study 1

Each year a primary school took their two Year 1 classes to a safari park. Whilst preliminary work for both of the classes centred on wild animals, habitats, predators and prey the follow up work after an over-cast, grey, May visit when animals tended to be asleep (classes spotted two crows, a blackbird and three lions asleep!) considered safari vehicles. The classes had been fascinated to see vehicles decorated with a range of animal patterns. Their teachers however steered the classes in different directions.

Year 1 SB: Children were invited to make models depicting animal patterns. The focus was to research the patterns, using iPads and then make models from boxes and jar lids. The majority of children stuck the 'wheels' on to their boxes with tape, few having the patience to let PVA glue dry. No wheels turned but patterns were effective for animal camouflage.

Year 1 RS: Discussion centred on the safari vehicles observed. Children were encouraged to analyse what makes something a vehicle. All were eager to make vehicles that would move with wheels that turned as well as have patterns that would provide camouflage for a specific animal. Children realised this included insects, birds and the larger animals commonly seen at a safari park. Over several weeks children investigated ways to make wheels that turned. Final vehicles included a wide range of different mechanisms. Additional features included registration plates.

- **Critical questions:**

Drawing on the discussion above, in which instance do you think the children engaged in Design and Technology as an art?

How could Year 1 SB be moved from engaging in arts and craft, to Design and Technology as an art approach?

Roden and Ward (2016 p.6) define the sciences as:

"A body of knowledge and a way of working"

Roden and Ward (2016 p.6)

The science in Design and Technology for many is perhaps, hidden. However, science is very much connected with the conceptual knowledge of materials and physical processes. Importantly, the process skills, seen within the science way of working exemplified in the investigation model, also contribute to our understanding of Design and Technology as a science. Whilst there is not a definitive, list of these process skills the two foundational skills of observation and questioning are fundamental to Design and Technology. Engaging in observation and the raising of questions generates ideas for products that meet genuine and authentic needs. However, the potential power of the process skills does not stop here! There are a number of process skills, that translate and transcend primary science and design and technology. Progression in the process skills in primary science has been widely mapped. This progression can be neatly be compared with the Programme of Study for primary Design and Technology.

Key reading 1

Roden and Archer (2017 p.11-12) have identified the progression in primary science across the primary phase. They use an approach know as 'One Science' that links the process skills to colourful icons. Children and teachers alike are known to draw on the symbols to help identify key areas of skills development. When planning teachers utilise the symbols to create a focus on a key skill in each individual lesson. Children are encouraged to employ the symbols to help plan enquiry and identify their learning focus in a particular learning episode.

Process skill	KS 1	Lower KS2	Upper KS2
Questioning	Asking simple question	Asking relevant questions	Planning different types of scientific enquiries to answer questions

 **Observation**	Observing closely	Making systematic and careful observations	Making systematic and careful observations
 **Prediction**		Use conclusions to make predictions for new values, suggest	Using tests to make predictions
 **Selecting equipment**	Using simple equipment Performing simple test	Setting up simple practical enquiries	Using equipment that assist observing and recording with increased precision, accuracy, and complexity (additional)
 **Selecting the one mode of enquiry**		Using different types of scientific enquiries to answer questions eg. comparative investigations and fair tests	Planning different types of scientific enquiries including recognising and controlling variables where necessary Using tests to set up further comparative and fair tests
 **Recording**	Gathering and recording data	Where appropriate taking accurate measurements using standard units with a range of equipment Gathering and recording in a variety of ways to help in answering questions Recording using simple scientific language, drawings, labelled diagrams, keys, bar charts and tables	Taking measurements, using a range of scientific equipment, increasing in accuracy and precision, taking repeat readings when appropriate Recording data and results in an increased complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs
 **Classifying**	Identifying and classifying	Classifying in variety of ways to help in answering questions	
 **Presenting**		presenting data in a variety of ways to help in answering questions Reporting findings	Reporting and presenting findings including conclusions, causal relationships,
 **Conlcuding**	Using observations and ideas to suggest answers to questions	Draw simple conclusion Use straightforward evidence to support findings	Identifying scientific evidence that has been used to support or refute arguments
 **Evaluating: Identifying barriers & ways forward**		Identify barriers and suggest improvements and raise further questions Identify differences and similarities or changes related to ideas and processes	Evaluate the trust/reliability of findings

Critical question

How might these process skills assist learning within primary Design and Technology?

Look at the National Curriculum programme of study for primary Design and Technology (DfE, 2013) and decide how these skills map into the skills required of those engaging in primary Design and Technology.

Being familiar with the requirements of the programme of study is essential if we are to be successful in our practice. In an era where teachers are known to have excessive workloads, the practice of searching for ways to expedite the planning process has become the norm. In addition, all too often practitioners report stretched timetables. Whilst we are not disputing these difficulties, adopting a scheme of work may inadvertently add to this problem. Familiarity with the National Curriculum assists practitioners to appraise schemes of work in an informed way. Not only will this assist in developing a secure understanding of what conceptual knowledge is required at each phase but this will assist you in developing a concrete understanding of the skills that are involved in Design and Technology and how these progress.

Key reading 1

Read and explore the Programme of Study for primary Design and Technology:

DfE (2013) Design and technology programmes of study: key stages 1 and 2. London: DfE

In the subject content for both Key Stage 1 and 2 is states:

"Through a variety of creative and practical activities, pupils should be taught the knowledge, understanding and skills needed to engage in an iterative process of designing and making."

(DfE, 2013 p.2&3)

Critical question

Hope (2018) defines an iterative process as:
"A cyclical process. In Design and Technology this means that the designing and evaluating continue throughout the whole process of planning and making a product"

(Hope, 2018 p.5)

Considering this, how might this influence the amount of time that is required for the design and make process?

What are the benefits of Design and Technology?

The infamous design and patron to the Design and Technology Association (DATA) James Dyson suggested that:

"Design and Technology is a phenomenally important subject. Logical, creative and practical… Policy-makers must recognise Design and Technology's significance for the UK economy and strive not just to preserve it – but to ensure it appeals to the brightest of young minds."

(DATA, n.d., n.p)

The benefits of Design and Technology are possibly too numerous to mention, however we agree with the above that it is time that policy makers took the value of Design and Technology seriously. Beyond the pure economic benefits discussed in the quotation, Design and Technology has the potential to enrich lives, spaces and societies on a human level.

Critical questions and Personal reflections

The following list suggests some of the wider benefits of Design and Technology. Do you agree with them? Are there any that you would change, adapt or erase? Are there any that you would add?

Once you have your statements, can you rank these from most important to least important?

Design and Technology offers children the opportunity to:

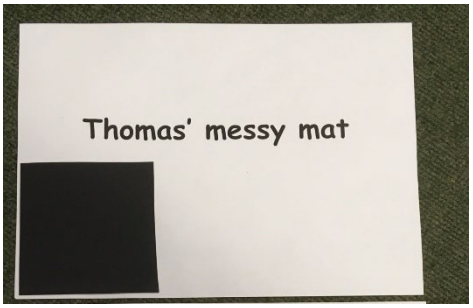
- be active learners;
- use problem solving skills and to tackle problems in real life;
- learn and use approaches and processes that will be appropriate through school and beyond;
- develop a broad range of key skills;
- look critically at the made world;
- foster links between subjects;
- be innovative, and develop and demonstrate creativity.

You may have found this reflection to be a tricky task. Our values influence our responses to the task but this does not necessarily mean that it is easy to champion one of the benefits above the rest. The listed benefits are integral threads that should be found within good Design and Technology practice. All of the listed benefits have value. Rather than producing a ranked list it may be helpful to see these benefits as key features which overlap and interlock. For example, at the heart of problem solving is the need for active learning that draws on appropriate approaches and processes is crucial. The case study below looks at this in further detail.

Classroom practice, The Messy Mat – Case Study 2

Each September, a Cambridge primary school asks all children in the first week of the new school, academic year to make a 'messy mat'. Messy Mats are pieces of A4 paper, decorated according to given criteria and then laminated to provide a wipe-proof mat. The reason for making the mats is two-fold: they are useful throughout the year for messy activities and they provide an invaluable way to assess skills such as the ability to use scissors, to design, to count and to follow instructions. Dependent on the year group the task can be changed. If mats are retained each year until the child leaves in the summer of the final year of primary school the mats can illustrate a child's development.

Thomas is a Year 5 child. He has been asked to do a mat based on a square that has 'exploded' into sixteen pieces and told that he must use all the pieces. Analysis of Thomas' mat indicates that he has good scissor skills. He can cut out intricate pieces with clean edges. When sticking, he uses the minimum amount of glue needed and all edges are secure. Thomas follows instructions – all pieces of the square are used and sixteen have been cut.



Critical question
What are the benefits of this activity?

Why might mapping progression in skills be an essential component in quality Design and Technology practice?

For further reading on assessment in primary Design and Technology read:
Hope, G. (2018) Assessing Children in Design and Technology. Chapter 7 in Hope, G. (2018) Mastering Primary Design and Technology. London: Bloomsbury

A brief History of Design and Technology
Design and Technology has a chequered history. There have been periods of varied fortune in which Design and Technology has resulted in it taking different forms for different cohorts of children. It is likely that it is this reinvention, and repackaging, that has led to the uncertainty amongst practitioners regarding the aims and value of this important subject.

Reaching back into the early 1800s pioneers such as Steiner introduced the concept of 'Hand Craft' which emphasised making from natural materials that could be found in the locality. A variation of this is still prevalent in Nordic countries today with children exploring traditional materials, products and techniques as an essential part of the curriculum. Froebel developed resources known as 'gifts' that help geometry awareness as well as building skills. He also identified what he referred to as occupations which included building structures with peas and matches, sewing and weaving, helped to reinforce the belief that there was great value in making. Looking back at this heritage it is possible to see that children have experienced an education that has involved making for centuries.

Before the formalisation of the curriculum there were several approaches that were adopted to a greater or lesser extent in local schools dependent on teacher interest. The tenets of needlework, woodwork and painting were commonplace in many primary schools in the 1960s, which led to an innovation in practice through the introduction of junk modelling. Having not made great strides for several years a great hive of activity in the 1980s led to a real and significant change in practice. The 1987 'Craft, design and technology from 5 to 16' HMI report legitimised Craft and Design and Technology as a subject area and birthed the Craft and Design and Technology (CDT) movement. The intention here was to support a view that would engender a sense of mastery. For contemporary practitioners the concept of mastery has been made prominent through developments in mathematics education and is now largely understood. Unfortunately, at the time such an understanding was not prevalent and all too often the 'C' was interpreted simply as arts and craft.

After much international debate, the formalisation of the curriculum, through an act of parliament, saw the C (standing for craft) being dropped and the inception of Design and Technology in the first National Curriculum (DESWO, 1989). Further iterations sought to refine and reduce the level of

content. Rose (2009, p.46) proposed the unification of Science and Design and Technology to form the scientific and technological understanding area of learning. Whilst the forming of a new government in 2010 meant that this plan did not come to fruition, it is important to note the political interest in unifying these subject areas. It is likely that this is a discourse which may well be revisited in future educational policy. History shows us that Design and Technology has been subject to change. Changes can be both positive and negative. The task of the primary practitioner is to know and understand what they believe to be the purpose of Design and Technology for themselves to ensure that primary school children continue to receive a quality education.

Critical questions and personal reflections

Based on your experiences as a learner and as a teacher if you were to create a new programme of study that included Design and Technology what would it be called and why?

Drawing on the brief history of education above it appears that changes to Design and Technology policy including the National Curriculum are likely to occur in your professional career:

- Why may the qualities of flexibility and resilience be important?
- What changes do you envisage happening in the future?
- Many schools, due to time pressures, resort to occasional 'Design and Technology Days' or alternate the subject each term with Art and Design. What do you feel is ideal for Design and Technology? In order for it to encompass the 'iterative process' should Design and Technology be timetabled to happen every school week?

The process verses product debate

In the previous section, that discusses Design and Technology as an art or science, this chapter has begun to explore the ideas of process and product. These two concepts are central to a contemporary understanding of Design and Technology. Hope (2003 p.88) discusses teacher tendencies to see designing as a single event in which children are invited to 'draw three and choose one'. She goes on to suggest that this is a rather unsophisticated understanding of design as a process. The figure below is based on Kimbell's (1986) model of the design process. A key difference between our model and his is the integration of the identifying the context or need in the process. Our belief is that this can change through a design journey and that it is important to acknowledge this. In addition, we have increased the number of arrows which we feel best describes the flow and potential for change that occurs when designing. Finally, we have further exemplified how we believe ideas can be develop in the design process.

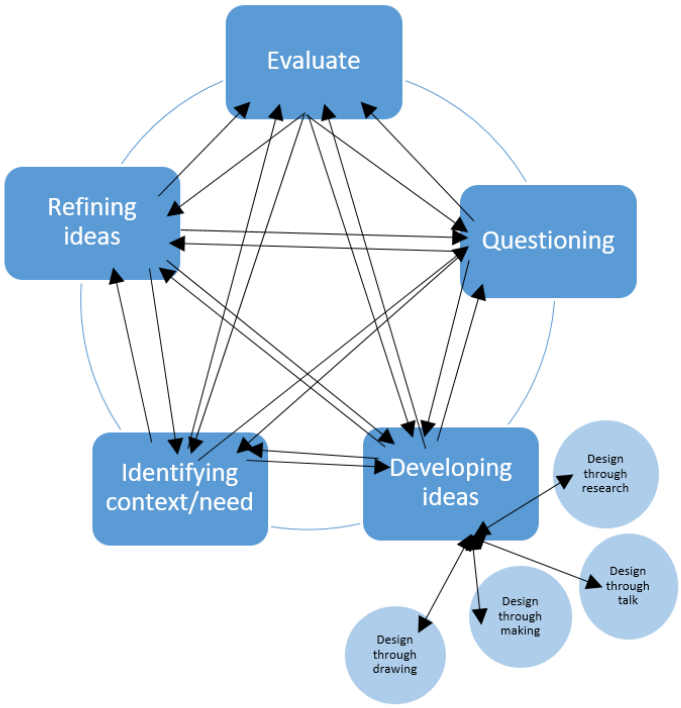


Fig. 1 – The messy design process

(Kay Stables, 1997) argues that it is the design process that should far outweigh the creation of a final product. She also challenges the practice of children ending up with identical products, suggesting that any outcome should reflect and be as unique as the design journey that the child has courageously undertaken.

Critical questions and Personal reflections

Looking at the model provided in fig.1 why might it be impossible for children to end up with identical products after engaging in an authentic design process?

For further reading on designing through making and designing through drawing see:
Archer (2015) An introduction to Design and Technology, chapter 4 in Driscoll, P., Lambirth, A. and Roden, J. (2015). *The primary curriculum*. 2nd ed. London: Sage.

Classroom practice, The case of the Christmas clothes hanger – case study 3

A year 2 class, in preparation for performing a play to celebrate Christmas was slightly perturbed when each morning they arrived at school to find their costumes on the floor. Many of the outfits, made from shiny, polyester type fabric had slipped over night from their clothes hangers. Whilst an observer might have felt a solution could simply be to place the costumes in carrier bags the class was adamant this should not be done because "the clothes will crease" and, in the words of Connie "We shouldn't use carriers because they're not good for the environment." This was the starting point for child initiated designing based on a genuine, identified need.

The class discussed, with their class teacher, during a 'carpet time' their concerns. The children offered reasons for why the clothes did not stay on the hangers. Stan thought a possible solution was to change the costumes to be made from "not slippy fabric" but the angels were definitely not in agreement! Leanne, however, having closely examined a simple, metal hanger wondered

whether the problem was for all hangers or simply the ones used. The following day children started to bring in hangers to analyse.

A line was erected across the classroom and children added hangers. The only rule for adding a hanger was that each one had to be different from all others on display. By the end of the week, around 100 hangers were available for sorting. Children examined the materials, the shapes and special features such as added clips and padding. Hangers were then tested, overnight, but sadly costumes still were discovered each morning on the floor. As a result, children then started to design their own hangers and a variety emerged including ones with "sticky pads that don't leave a mess", irons, "anti-crease plastic" and "anti-smell blobs". Over a two-week period children were passionate in their desire to solve a problem and thoroughly engaged in their aim to create hanger designs that offered a solution.

Note: And in case you like a happy ending, you might wish to know a solution was, in the end, found. The cleaner was asked, when hoovering each night, to avoid the area where the clothes were hanging!

Critical questions
Which elements of the messy design process from fig.1 were evident in this case study? Can you map this out following the arrows?

Considering that the children did not make the hangers, what do you feel was the value for the children in engaging in the design process?

Agency in Design and Technology

Pierre Bourdieu was one of the leading thinkers to consider identity. Mercer (2011, p.428) explores his idea of agency suggesting that it is the essential trait seen in human activity and that it is concerned with the individual's ability and capacity to act. Oswell (2012) furthers this idea suggesting that in relation to children's education agency is:

> "Children's and young people's capacities to make a difference (rather than being constituted as difference)"
>
> (Oswell, 2012 p.6)

Fundamental to quality Design and Technological education is this notion of agency. Children being able purposely to manipulate, adapt and change the processes, ideas, concepts and materials that they come in contact with is the cornerstone to quality practice. It will result in individual rather than identical outcomes. The journey will be more involved and messy when children are enabled to act and make a difference in the design process. Often the difference between primary Design and Technology and 'real world' Design and Technology is the sense of authenticity. This can be achieved by placing the child centrally within the design process, seeking to let them solve real problems in their own way.

Design and Technology for inclusion

As an early years practitioner a clear success of quality Design and Technology is that it enables the benefits of child initiated learning, which begins in the Early Years Foundation Stage (EYFS), to continue across the primary phase. This is key to its inclusive potential and helps to ensure that 'there are no barriers to every pupil achieving' (DfE 2013 p.8).

In the following 'thought piece' Esther Cummins (SENDCo) reflects on the power of Design and Technology, to enhance inclusion, drawn from her experiences as Inclusion Manager within three primary schools. She had responsibility for SEND, EAL, and other Additional Educational Needs that arose within children's educational journeys.

Thought piece 1

"My experience in school has helped me to understand the complexity of 'inclusion'. The range of needs that children had predominately stemmed from how we do learning in school rather than something being 'wrong' with the children themselves. One example of this would be the emphasis on writing within primary classrooms; children who had dyslexia, were new to English, or who had some speech and language difficulties, may have needed additional support or differentiated learning activities during such lessons. However, teaching a broad curriculum in a more balanced manner would mean that some of these children would exceed their peers within subjects such as Design and Technology. I remember one child in Year 5 was working below age expectations in maths and English who created a very complex fairground system with Meccano; his sense of achievement was immense.

Beyond the interest and abilities that children may have in Design and Technology, I also recognise the importance of the subject for supporting children's development. I have worked with several children who had difficulties with fine motor skills, and commonplace activities such as holding a pencil was very challenging for them. When I worked in Early Years settings, I noticed that children who would usually shy away from writing would use the 'workshop' or the construction area. As they created, I realised that these were not ad hoc creations but thought through designs that reflected their lives and interests, such as garages made from Lego, pirate ships made from blocks, and wands made from recycled materials. The children were able to problem solve and create whilst developing their fine motor skills through placing blocks together, cutting, drawing, sticking, and pulling apart Lego bricks. These vital skills were not only the pre-cursor for writing but also valid dexterities in themselves. As an Inclusion Manager, I realised how we often saw such activities as pre-writing only, instead of celebrating the successes that children had had when gaining these new skills.

For a child new to English, the primary classroom can be a daunting place. Design and Technology offers opportunities to access the 'known' whilst extending learning. I often feel that the designing of a sandwich is a brilliant example of how learning can be culturally and linguistically inclusive. Through exploring types of sandwich, children new to English can exchange words for bread, cheese, tomatoes, butter, and so forth, with their peers. The teacher can include fillings that do not segregate any learners (EAL or not), such as avoiding meat that is not halal or kosher, or even providing purely vegetarian options. In addition, the range of bread can enable children to explore new and familiar options, as they taste naan, pitta, granary, sourdough, rye, baguettes, and bagels. Through these opportunities, informal learning can take place without creating a false experience to learn about culture. These natural opportunities can go beyond the learning of skills that can be easily assessed, such as using a knife, and, I believe, can last into adulthood in the same way that learning to make a sandwich can." (Esther Cummins)

Developing children's skills with tools and techniques is crucial in Design and Technology. Working with focus groups here can be key. In small groups children can work on Focused Practical Tasks (FPTs) that may assist children to develop skills that may be useful for the children to draw on when designing. Mapping this activity across a school can help to give an overview of the skills that the children are supported with and may have acquired. All too often children receive repeated input on basic skills. Children must be able to see how the challenge in skills progresses over their time in

schools. During FPTs the teacher can draw on the school's skills provision map to help review what the children have previously engaged in and use this as the platform on which new skill acquisition can take place. FPTs can be successfully completed on a carousel with children rotating around in small groups to different FPT inputs. Drawing on parent and carer support in such activities or inviting older children in from class in years above to model skills to children can be useful here. Acquiring these skills is essential in developing child agency in the design and make process.

Helping children to engage in the design process authentically involves acknowledging that there a many different ways to design beyond drawing. Indeed, design drawing requires the child to work in abstract thought, turning this into abstract drawings after which the child has to take the large leap to see this become a concrete product. Alternatively, making as design enables dialogue between abstract thought and the concrete action of making. This process often results in children refining and adapting ideas more easily. Creating mock-ups out of scrap materials such as newspaper helps children encounter the challenges their design will face. Challenges such as how one will join materials or ensure the product has the desired qualities become tangible and the child is forced to address these in a way that abstract thought and drawing alone would not. It could therefore be argued that this approach to design in the primary phase enables the greatest sense of agency.

- **Classroom practice – case study 4 Choice – the design trolley**

Hamish, a lower key stage two teacher was keen to develop a greater sense of independence in design and making for his class. Exploring practices seen in the foundation stage he was persuaded that it would be beneficial to look to create an environment for design. With a limited budget he set about his own design and make challenge to create a Design and Technology trolley for his classroom. The cost of a similar trolley from an educational supplier was far too great and often these products were much too small for the children in his class.

Hamish ordered a wooden vegetable trolley, a kitchen roll dispenser, plastic food storage jars, metal plant pots and used his drill and a few screws to create a Design and Technology trolley that was not only a quarter of the price compared the products he had looked at aimed at the EYFS but was also appropriate in terms of dimensions and resources for the age of the children in his class. Using the shelves, storage jars and metal plant pots to separate out materials into groups and placing reels of tape on the kitchen roll dispenser Hamish was pleased with they way the materials had been able to be organised into a single area, with the materials in clearly defined places. With the wheels on the trolley this could be moved to any position in his classroom.

Within a few days of being in situ in the classroom Hamish noticed how excited the children were to have a Design and Technology trolley. He observed that children were talking more about making things and were discussing their design ideas with each other at moments outside of Design and Technology sessions. The children also started to use the resources and materials in other lessons with a clear example being the children creating props when exploring stories orally together.

By the end of the year, design by making, became a natural part of the children's weekly experience even if they were not undertaking formal Design and Technology sessions. Hamish saw that the children grew in independence when designing by making, selecting the material and resources that they required themselves rather than having to ask an adult for these. This independence created a noticeable increase in the children being prepared to 'have a go' and try out ideas.


Critical questions
What do you believe that value may be in developing independent designers?

How could you seek to develop environments that promote design?

The future, potential of Design and Technology

Anna Craft (2001) highlights that the unenviable task of the primary teacher is to prepare children for an uncertain future. She suggests that the best way in realising this is through adopting approaches that seek to release children's creative potential and capabilities.

In recent years, global and environmental issues have come to the forefront. We believe the future of Design and Technology lies in its potential to help children explore the role of design in tackling some of these environmental issues in creative and innovative ways. However, Elshof (2005) warns that few pre-service teachers are fully aware of how to approach ideas such as 'sustainable development'.

- **Case study 4, Design and Technology for sustainability - Eco bricks**

Lucinda, an upper key stage two teacher planned to explore theme of 'Being a Friend to our world'. This cross-curricular theme drew on the links with the programme of study for primary geography, science and Design and Technology. From the start of the academic year, she had held an after school club to which children, parents and carers were invited. These sessions took the flavour of a community project with participants working together to make eco bricks out of plastic bottles and non-recyclable plastic waste. The whole school was involved in collecting bottles, bringing in washed and dried plastic waste.

By the final term the group had built up an impressive number of eco bricks. Lucinda presented these to her class and challenged them to work in small groups to design and make products that would improve the school's environment. The class explored www.ecobrick.org to get inspiration. Lucinda found that this was not only an important step in the children developing an awareness of the product but was useful in connecting children to the big ideas, and other projects, from around the world adding a truly global dimension to the work.

Using the materials and masking tape, the children began to develop their understanding of how the materials could be joined and how structures could be made. Designs for a table, chair, flower planter and even a float for the school swimming pool soon emerged. Working alongside some of the parents and carers from the community project club, the children were able to realise their designs.

Critical questions:
Who benefitted from the Design and Technology learning experience?

How might designing for sustainability within a school's provision in Design and Technology help release the subject's future potential?

Chapter summary

- Design and Technology should be recognised as a separate subject from Art and science. It goes far beyond the reaches of craft. It seeks to involve children in an authentic, iterative, purposeful process whereby consideration is given to the user and functionality of a 'product'. Throughout this process, children navigate a range of often-tricky design decisions.
- Design and Technology has had different guises since its formalisation as a discipline through the first national curriculum (DSWO 1989).
- Contemporary research highlights the importance of confidence and competence. The literature suggests that quality practitioners in primary Design and Technology are aware of the progression in skills that should occur across the primary phase. They also seek to provide time for the iterative nature of design.
- Not all primary Design and Technology may result in a physical product. We have suggested that the design process is as important, if not more so, than the production of artefacts
- Through Design and Technology there is tremendous potential for agency for teachers and children, however we suggest that a shift in practice may be needed to realise this fully.
- The future for Design and Technology lies in its potential to meet real, current and future issues head on including topics such as climate change and sustainability.

- **Further reading suggestions**
    1. **A** Hope, G. (2018) Mastering Primary Design and Technology. London: Bloomsbury
    2. **B** Benson, C. and Lawson, S. (2017). *Teaching design and technology creatively*. Lodnon: Routledge.

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