Art and Design and Design and Technology: Is there creativity in the designing?

Dr Marion Rutland, Roehampton University

RESEARCH

Abstract

This paper explores the potential of 'blurring the boundaries' between art and design and design and technology with specific reference to 'improving creativity' in design and technology, as recommended in an inspection report of secondary and primary schools in England by Ofsted (2008: 7). The paper explores the evolution of the English National Curriculum in art and design and design and technology. It discusses the impact of the 2007 programmes of study for Key Stage 3 (pupils aged 11-14 years) in the context of commonalities across the two subjects with specific reference to designing and creativity. It looks at the increased interest in creativity in the curriculum and presents the findings of a small-scale research project exploring creativity in art and design and design and technology. The development of a three feature model that can be used for analysing creativity in an educational context is described together with a model for helping pupils make design decisions. The paper continues with a brief review of units of work in art and design and design and technology and identifies similarities and differences of approach and outcome.

It concludes that designing is a creative activity used by professional designers; however, there are issues of whether pupils, as novice designers, can rely solely on learning the process of 'designing' to ensure their creativity potential in the context of a school classroom. As a complex concept creativity, depends on the convergence of a number of features. These include sound domain or subject knowledge and skills, process-relevant features that control the direction and progress of the creative process and social, environmental features that ensure a supportive, conducive environment that enables pupils to be confident, motivated and able to take risk. The role of the teacher in ensuring pupils' creativity is crucial in that they need to plan interesting open-ended units of work, give pupils opportunities to make design decisions, 'dwell time' for reflection and plan the effective use of resources and space. It suggests that collaboration between teachers of art and design and design and technology would be beneficial in the quest for creativity within the context of appreciating the similarities and differences of the subjects.

Key words: art and design, design and technology, creativity, designing

Introduction

The paper focuses on the potential of 'blurring the boundaries' between art and design and design and technology with specific reference to 'improving creativity' in design and technology as recommended in secondary schools in England by Ofsted (2008: 7). The need in the long term to improve technological rigour in design and technology through links between science, technology, engineering and mathematics is also noted as important, but this is not addressed in this paper (ibid: 7). The first section outlines the evolution of the English National Curriculum in art and design and design and technology up to the impact of the introduction of new programmes of study in 2007. The second section explores the increased interest in creativity in education in England and outlines the findings of a small scale research project exploring creativity in the two subjects. Section three describes a three feature model for analysing creativity in an education context together with a model for helping pupils make design decisions. The paper concludes with a discussion of designing and creativity.

The evolution in the English National Curriculum in art and design and design and technology.

The subject of art has a long history within the primary and secondary school curriculum in England. It has been described as an open concept, a cumulative category of objects and processes, which by its nature is not easily definable that includes intrinsic aptitudes such as creativity and imagination, self expression, spatial awareness, visual and physical acuity. Extrinsic aptitudes such as the ability to describe, analyse, develop intercultural awareness, plan and execute, develop arguments and view points, collaborative peer working and self directed learning are included.
http://openlearn.open.ac.uk/mod/resource/view.php?id=167577.

In a report written by the Arts Council (2008) it was found that people describe the value of the arts as a capacity for understanding and navigating the world, its ability to enrich people's experiences of life providing colour, beauty, enjoyment, relaxation, a source of solace and escape and an important emotional outlet. Wider outcomes include bringing people together, creating links between communities with pride in their local area. In schools it is a subject that has long held credibility and respect from the

general public, including parents and has been taught to boys and girls of all abilities and ages within an established framework. Yet, there have been issues regarding current teaching. It has been argued that much school art reaches back in to the nineteenth century and is isolated from current professional practice (Hughes, 1998). Similarly, the demands for greater teacher accountability have led to even tighter control of the curriculum and its assessment (Steers, 1997).

On the other hand, design and technology as we know it today is where 'pupils learn to design, make and evaluate functional products and systems' (Ofsted, 2008, p 8), has come from a different background and lacks a similar clarity of understanding. There is a common perception that this school curriculum area has evolved only since the late 1960s through the work of the Schools Council projects, HMI, local authority (LEAs) initiatives and school examinations (Kimbell and Perry (2001). However, its actual roots extend much further back into the early eighteenth century in elementary schools where it was as a craft based subject, with technical studies for boys and domestic subjects for girls. Before the National Curriculum in 1990 'the subject evolved from a group of closely connected practical and technical subjects' (Ofsted, 2008: 9). There was a range of freestanding craft-based subjects available to all pupils, but it was generally the less-academic pupils that followed such subjects from the age of 14 years (Penfold, 1988; Sillitoe, 1966). When the National Curriculum in England was introduced (DES, 1990a) it was essentially subject based and has remained so up until the present with the Revision of the National Curriculum (DfEE and QCA, 1999a) and the revised design and technology Key Stage 3 (pupils 11-14 years) programmes of study (QCA, 2007).

When the National Curriculum was introduced (DES, 1990a) design and technology was a compulsory curriculum subject for pupils aged 5-16. However, the place of art was limited as a compulsory element to pupils aged 5-14 years in the National Curriculum and in the revisions of 1995 and 1999 (DfE 1995a DfE, QCA, 1999a). The established position of art in both the primary and secondary curriculum before the introduction of the National Curriculum ensured that from the beginning art teaching did not suffer from the lack of expertise and understanding that bedeviled design and technology (Barlex, 2003a). It must be acknowledged that initially good practice in design and technology was hard to find and the reports from HMI in the early years of the National Curriculum make sorry reading (Department for Education and the Welsh Office 1991 and 1992). However, those teachers in secondary schools who had, at a stroke and with little, if any, retraining, been reclassified as design and technology teachers (in the main, originally from home economics and craft, design and technology) responded positively to the challenge with the result that standards during the period 1993-1997 as evidenced from an Ofsted inspection (Ofsted 1998) have improved steadily. In the early days of the National Curriculum the subject covered an excessively broad range of content, that was frequently taught at the expense of technical rigour and depth and this, to some extent, remains an issue today. Though much has been achieved in developing design and technology, deficiencies persist and the subject lacks strategic, long term planning and support (Ofsted, 2008).

However, in the early 1990s there was concern that art, as defined by the National Curriculum (DES, 1990b: DfE, 1995b), did not include design either explicitly in its title or in the content of the programmes of study. In the revised Orders (DFE, QCA, 1999b) the word 'design' was reinstated and the subject of art became 'art and design' with programmes of study revised to reflect this. However, this does leave scope for confusion if the nature of design in each of these subjects, and how they relate to one another, is not clear to teachers. Topics which legitimately arise in both curricula may be taught in both subject areas with no connections being made by teachers or pupils, a situation that leads to wasted time and the loss of valuable opportunities for enriching pupils' learning. At a more fundamental level, pupils develop knowledge, understanding and skills in a fragmented way that fails to empower them.

The latest development has been the introduction of new programmes of study with common curriculum aims for all subjects for pupils at Key Stage 3 (QCA, 2007). The importance statements for art and design and design and technology include 'in art, craft and design, pupils explore visual, tactile and other sensory experiences to communicate ideas and meanings' (ibid: 17) whereas in design and technology 'pupils combine practical and technological skills with creative thinking to design and make products and systems that meet human needs' (ibid: 51). However, it is important to note that 'design' is a common term in both statements.

Other commonalities across the two subjects are revealed through an examination of the key concepts and key processes (Table 1). The terms modelling and products are the focus in design and technology, as are technical, economic or environmental understanding of issues related to sustainability, applying knowledge of materials and production processes. Whereas, in art and design

Art and Design and Design and Technology: Is there creativity in the designing?

pupils make purposeful images and artifacts and explore and present ideas using sketch books, journals and other appropriate strategies. Designing as a term is used in both subjects but its interpretation varies. In design and technology *designing and making* is a separate key concept that includes developing utilitarian, practical, relevant solutions fit for purpose alongside an understanding of their impact on the quality of life. Designing explores how products have been developed in the past, the present and possibly in the future, with pupils expected to use others' designing to inform their own. In art and design, designing is within the key concept of *competence* alongside investigating, analysing, making, reflecting and evaluating effectively. It highlights designing for different purposes, vocational and work related practice and an understanding the role of the artist, craftsman and designer.

The importance of creativity, and the ways in which it can be achieved, shows more commonality, though the importance of taking risks and learning from mistakes is only mentioned in art and design. Common terms and concepts are investigating, analysing, critiquing, making informed choices or decisions, reflecting and developing cultural understanding. Exploring visual tactile and other sensory factors and working with first hand observations are individually identified in art and design but included as aesthetic dimensions in design and technology. Creativity in design and technology is seeing possibilities, problems and challenges and visualising alternatives to develop innovative products and processes. It involves exploring and experimenting with ideas, materials, technologies and techniques. In art and design creativity is producing imaginative images, artifacts and other outcomes that are both original and of value. Pupils show creativity when they play with ideas and generate different approaches, responding to purposeful tasks in imaginative and personal ways to produce original images and artifacts. Originality is defined in terms of pupils' own previous work, the work of their peer group or what others have produced.

Art and Design	Design and Technology
Key Concepts • Creativity: produce imaginative images & artifacts that are original & of value; explore & experiment; take risks & learn from mistakes. • Cultural understanding: engage with images and artifacts from different cultures; understand the role of the artist, craftsperson & designer. • Critical understanding: explore visual, tactile and other sensory qualities; develop views; analyse and reflect on work from diverse contexts. • Competence: investigating, analysing, designing, reflecting, making, reflecting & evaluating, make informed choices about media, techniques and processes.	**Key Concepts** • Creativity: link principles of good design, existing solutions & technical knowledge; reinterpretate and apply learning in new design contexts; explore & experiment with ideas, materials, technologies & techniques. • Cultural understanding: of beliefs, ethics, values & traditions. • Critical evaluation: analyse existing products, solutions; evaluate needs of the user & context; explore impact of ideas, design decisions and technologies. • Designing and making: aesthetic, environmental, technical, ethical & social dimensions; apply knowledge of materials &, production processes to produce relevant products/practical solutions fir for purpose; understand impact on the quality of life; explore past & present products.
Key Processes • Explore and create: work with first hand-hand-observations; investigate how to express and realise ideas; make purposeful images and artifacts; draw; explore and develop ideas. • Understand & evaluate: use research and investigative skills; appreciate codes and conventions; reflect and evaluate; analyse, select, question critically & make reasoned choices; develop ideas and intentions; organise & present using journals, sketch books etc.	**Key Processes** • Generate, develop, model and communicate ideas. • Respond creatively & develop their own proposals. • Apply knowledge of materials. • Use others' designing to inform their own. • Plan and organise activities. • Solve technical problems. • Reflect critically when evaluating & modifying. • Evaluate use of tools, equipment & computer-aided facilities.

Table 1. Summary of key concepts and processes in revised Key Stage 3 Programmes of Study for art and design and design and technology. (QCA, 2007) http://curriculum.qca.org.uk/

Art and Design and Design and Technology: Is there creativity in the designing?

Creativity in the curriculum

The Robinson Report (DfEE, 1999) had an explicit focus on creativity not seen since the introduction of the National Curriculum in 1990 (DES, 1990a). It explored the nature of creative activity in different subjects and the most effective ways for teachers to engage their pupils in creative activity. The four features of creativity described (DfEE, 1999: 29-31) are imaging by thinking, behaving or 'doing' to generate something original, applying imagination to make or produce something judged as original against an individual's previous work within a peer group or against other people's previous output, that is of value in relation to the task in hand. Creative teaching was defined in two ways, firstly 'teaching creatively' and secondly 'teaching for creativity' (ibid: 89). Teaching creatively was interpreted as teachers using imaginative approaches to make learning more interesting, exciting and effective. This could be described as 'good practice' where teachers themselves are highly creative and develop materials and approaches that interest and motivate pupils. Whereas, in teaching for creativity, the focus is on forms of teaching that are specifically intended to foster or enhance pupils' own creative thinking or behaviour. It must 'balance structured learning with opportunities for self-direction and the management of groups with attention to individuals' (ibid: 95). It was noted that design and technology did not have a high priority in the Robinson Report (DfEE, 1999), though there was recognition of the potential for creativity in 'designing' (Barlex, 2003b). It was seen as conceiving and realising practical products and solutions with design processes integral to the ways in which the social cultures are shaped and expressed (DfEE, 1999: 71). Whereas, on the other hand in the arts creativity was seen as concerned with understanding and expressing the qualities of human experience (ibid: 69).

The potential differences of the interpretation of creativity in different subjects is illustrated by the following thinking (Rutland and Barlex, 2002; Barlex 2003a). In the performing arts, for example, to what extent is taking part in a performance that has been conceived and written by somebody else (Joseph and his Amazing Technicolor Dreamcoat, for example), and will be directed by another somebody else, a creative activity? There is no doubt that the actors, dancers and musicians are involved in a creative endeavour. There is no doubt that it is a highly educating experience and that each actor can bring a level of personal interpretation to their roles depending on the openness of the director of the performance. But is this creativity different from the creativity of visual artists who conceive the new in the mind's eye and transform this concept into a physical reality by making pieces of art? And how is this creativity related to the creativity of designers who may develop new concepts for products (not always as a solitary activity) but then have little if any involvement in the realisation of those products? It is of course quite possible for an individual pupil or group of pupils to conceive a piece of performance art and execute it.

Exploring creativity in art and design and design and technology

A preliminary case study of a larger small-scale research project explored the practices of art and design and design and technology teachers (Rutland, 2003; 2005). Through the joint Nuffield Design and Technology and Qualifications and Curriculum Authority (QCA) Project, 'Creativity in Art and Design' and Design and Technology'. In early 2000 twenty art and design and design and technology teachers in England for pupils aged 5-16 years met to discuss and present examples of their work. Four criteria were identified that had to be in place for pupils to act creatively in either subject. They were:

- the activity had to be presented in a pupil relevant context;
- the activity had to be supported by a significant *stimulus* which was often, but not exclusively, intensely visual;
- focused teaching was necessary to provide *knowledge, understanding and skills*;
- an attitude of continuous *reflection* needed to be encouraged.

In Autumn 2000 six art and design and four design and technology teachers planned, taught, documented and assessed a unit of work for their pupils across the age range of 5-16 years. They were asked to use the QCA planning framework for their subjects' (DfEE and QCA, 2000 a and b). During November and December 2000 half day visits were made to three primary and three secondary schools for art and design and two primary and two secondary schools for design and technology to explore five key issues with the headteachers and teachers in the schools. These were the ethos of the school and its vision for creativity in the curriculum; the perceptions of the headteachers and teachers of the role of art and design and design and technology in their curriculum; examples of curriculum work on creativity; how the teachers fostered the creativity of their pupils or taught *for* creativity and what they saw as constraints for teaching *for* creativity.

The findings identified that four criteria had to be in place for pupils to act creatively in either subject, but that they alone would not ensure creative activity. The deciding factor was the way in which they are managed, so that

pupils can handle uncertainty in generating, exploring and developing outcomes. These findings indicated clearly that classroom management should become the focus of future research and that there was a clear link between the findings and the work of Amabile (1983, 1996). She identified three features which needed to converge for creative activity to occur. First, intrinsic motivation as a feature which can be developed by the teacher through placing the work in an appropriate context to which the children can relate and providing a stimulus which awakens their senses and sensibilities. Second, domain relevant knowledge and abilities, which can clearly be taught through focused teaching. The third, creativity-relevant skills, are perhaps more difficult to provide than the other two but without it the teacher cannot influence pupils' ability to respond creatively. The Nuffield/QCA features that influence pupil creativity are related to those identified by Amabile. Inspection shows that the context, and stimulus and need for reflection can be related to social and environmental factors; the need for knowledge and skill taught through focused teaching can be related to the domain relevant issues and creativity relevant processes. Both descriptions need to acknowledge the importance of handling uncertainty. This is illustrated in Figure 1.

The overall findings from the study indicated that there are common factors in teaching *for* creativity in art and design and design and technology. These included an ability to integrate teaching strategies and approaches that fostered pupils' creativity into their lesson aims and objectives, a supportive school ethos, local environment and well-qualified teachers. The development of technical and constructional creativity was generally the main focus for design and technology teachers, especially in the lower secondary school. These were considered important by art and design teachers but the importance of aesthetic creativity and the need for pupil choice and decision-making were given higher status. They placed more importance on allowing pupil to make their own design decisions, being given reflection time for thinking through their ideas and developing aesthetic criteria.

In contrast to art and design, a key factor for secondary design and technology teaching, was the type of design brief frequently set. They were restrictive and 'closed down' creative thinking from the beginning of the 'project'. Pupils are going to design and make a '…….'. Particularly in the lower secondary, the context and the use of interesting and visual stimuli was not of high importance and the teachers did not value motivating pupils by exploring, observing and considering different, but relevant, outcomes.

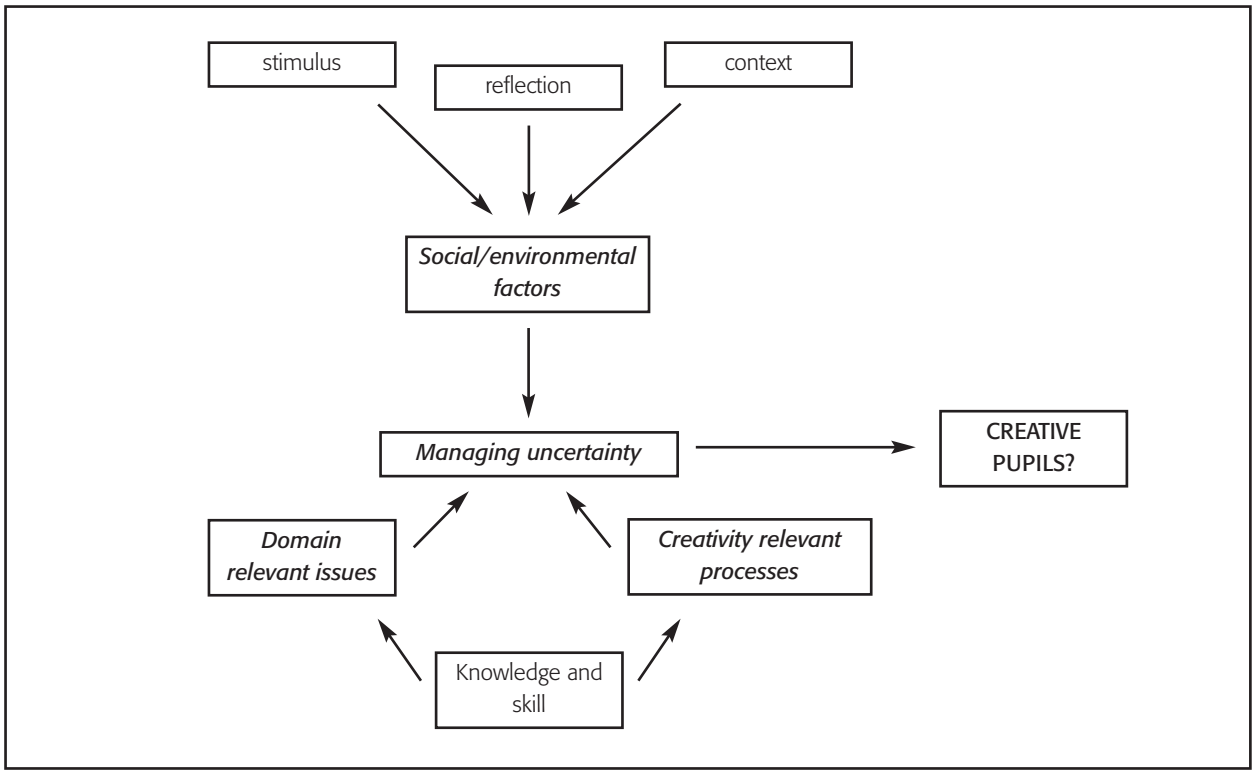

Figure 1. Features necessary for creativity in art and design and design and technology (Barlex, Rutland, 2002)

Art and Design and Design and Technology: Is there creativity in the designing?

In secondary design and technology the design activities used were generally limited and did not include group work or developing knowledge and skills alongside opportunities for making design decisions to produce originality. The teaching strategies used in design and technology, unlike as found in art and design, had more in common with a 'hegemonic' style (Murphy, 2003). This was not the situation in the primary schools where the pedagogical tradition of group activities and the use of a range of teaching strategies were common practice for both art and design and design and technology teachers.

There appeared to be fundamental differences of opinion by teachers of each subject of the appropriate content, methods and outcomes of practical craft activities. Art and design emphasised aesthetic criteria such as imaginative and expressive qualities through starting points such as 'Sagrada Familiar' by Antonio Gaudi and made links between building and natural objects. Pupils were expected to make connections by exploring shapes and symbols in the paintings of Miro. They were introduced to the surrealistic movement, for example dreams and their thinking was widened though other artists such as Dali. They were asked to interpret lines and shapes in the paintings and were encouraged to be reflective.

In secondary design and technology teaching there was an emphasis on functionality and problem solving. Pupils were allowed to change the shape of their notebook and were taught a range of tasks, for example transfer, surface design and 'neaten' a seam. They developed a prototype by modeling their ideas in paper. Essentially, the work was more 'needs' driven. In a six week 'Toys on wheels' in Year 9, individual pupils spent three weeks designing, for example sketching and developing their ideas and three weeks making. Clear criteria were set and skills demonstrated, for example use of a drill. Pupils were given the basic shape, a choice of two sizes of wheels and encouraged to produce ten to twelve facial expressions with a range of resources. They were expected to think about how they could be manufactured in bulk (Rutland, 2005).

A further exemplification for the differences between the purposes of two pupils' activities, one in art and design and one in design and technology activities was previously reported (Rutland and Barlex, 2002; Barlex 2003a). In art and design the pupil painted a highly personal picture using observational drawings and the stimulus of sprays of bluish-mauve Michaelmas Daisies emphasising the aesthetic feature of colour. He was asked to paint one flower but he became 'lost' within the activity and went on to produce a very personal, creative composition. In design and technology the pupils' task was to design and make a play mat for children in a play group to meet the needs of others. She was taught technical knowledge and skills to use the sewing machine, how to use 'bondaweb' and fabric dyeing. She investigated different fabrics and the kind of surface designs young children might like, for example farm animals. When the play mat was finished she evaluated it against the design specification by allowing a group of five year olds to play with it.

A three feature model for analysing creativity.
A three-feature model was developed to analyse creativity within an educational context (Rutland, 2005; Rutland and Barlex, 2008). The overall aim was to develop a theoretical model, or framework, that could be used to collect and analyse data to highlight examples of good classroom practice and identify 'gaps' that should be addressed. An international literature review in the field of psychology was carried out to attempt to define creativity, though this proved to be a complex matter. A consensus was that 'big' creativity is when something of enduring value is developed that contributes to an existing field of knowledge and transforms it, whereas 'small creativity', though equally valuable gives a fresh and lively interpretation to an issue (Feldman et al, 1994).

The views of Amabile (1983, 1996) proved to be highly influential as she highlighted the impact of specific social factors and intrinsic motivation on creativity and described creativity as the confluence of intrinsic, or self, motivation, domain-relevant knowledge and abilities, and creativity-relevant skills. The creativity-relevant skills relate to strategies and approaches that the teacher teaches pupils so that they have some tools for being creative. A multi-component approach was taken as it emphasises the importance of the environment as stressed by Amabile (1983, 1989, 1996) and highlighted that creativity only occurs when the three features converge (Csikszentmihalyi, 1994, 1999 and Feldman, et al. 1994).

In the model, or framework, for creativity the three features are:

1. ***Domain relevant features*** *– a set of practices associated with an area of knowledge, for example design and technology or other subjects such as science, mathematics.*
2. ***Process-relevant features*** *– influencing, controlling the direction and progress of the creative process.*
3. ***Social, environmental features*** *– macro/micro environmental, social and cultural issues.*

The fourth essential element of creativity, the 'person', or pupils in the classroom was central to the model, and

RESEARCH

reflects the impact of the three features on individual pupils' creativity. However, it was suggested that it is the teacher who is the key factor and fosters pupils' creativity through the domain, process-relevant and social-environmental features of the model. These features will interact with each other and one way to show this is to represent each feature as a vector making a contribution to creativity. The length of the vector will indicate the significance of its contribution. If each feature makes an equivalent contribution then the envelope of the three vectors will be an equilateral triangle. If the features make differing contributions the envelope shape will change accordingly (Fiqure 2). Domain relevant features are

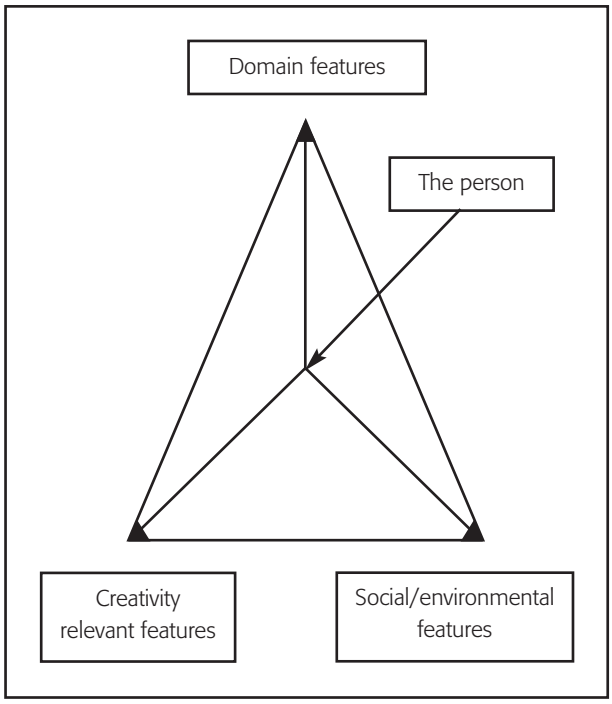

Figure 2. Three-feature model to analyse creativity

specific to individual subjects but the process relevant and social/environmental features are generic and can be used to analyse creativity across curriculum subjects.
The model was used to analyse creativity activity within a classroom context (Rutland, 2005; 2008) and a review of teaching resources for their potential for pupil creativity (Rutland, 2007a). Though, it has currently been used in design and technology, the model with modification in the domain, or subject features, has the potential to analyse creativity in other subjects.

Making design decisions

The level of pupils' creativity in either art and design or design and technology will depend on the extent to which they have control of the ideas they eventually turn into a response or a product. Creative design decisions within the domain of design and technology have been described as requiring:

- A concept: that considers originality; novelty; feasibility, usefulness and function.
- Aesthetic criteria: requiring the pupil to consider 'ways in which the product will appeal to the senses' - sight, hearing, touch, taste and smell.
- Technical criteria: requiring the pupil to consider 'how the product will work' and the nature of the components and materials required to achieve this.
- Constructional criteria: requiring the pupil to consider 'how the product will be made' and the tools and processes needed to achieve this.

(Rutland 2005; Rutland and Spendlove, 2007)

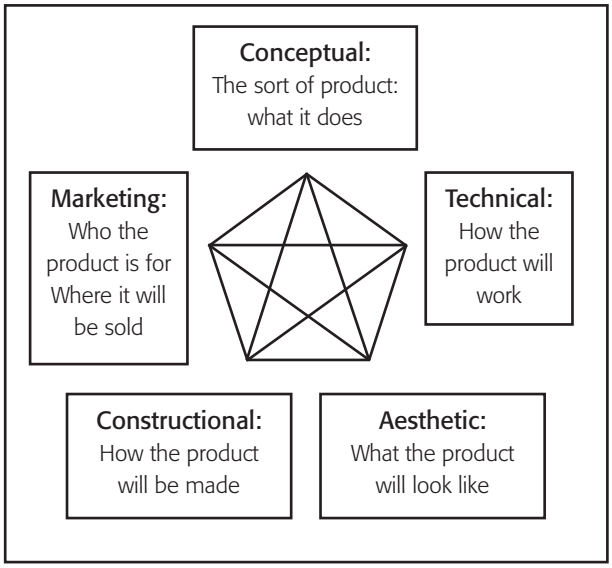

Figure 3. The design decisions pentagon

A fifth criteria or design decision 'marketing' is included in the design decision pentagon (Barlex, 2007a and b). It explores who the design is for, where it will be used and where it will be sold (Figure 3). It is an interrelated model where a change of decision within one area will affect some, if not all of the other design decisions. The model can be used as a formative or summative tool to encourage pupils to track and evaluate their design decisions at relevant points during a designing and making activity. The model encourages 'pupils to focus deliberately, but not exclusively, on particular features of his or her designing without loosing the important holistic overview of the design process' (Barlex, 2007a). The model has proved to be a useful tool and framework for supporting sound decision making when design and making. It has been refined and used by pupils and students in all the focus areas of design and technology,

including food technology, resistant materials, systems and control and textiles technology, to evaluate, refine and develop their design decisions and foster their creativity when designing and making (Rutland, 2007b; Rutland & Miles-Pearson, 2007). However, the pentagon at present focuses on a producing a 'product' and includes terms such as 'marketing'. Its potential for art and design is not explored at this point in time and would need to be clarified and refined within the expectations of the subject.

Discussion

So, is it possible to develop creativity through designing, is there a difference between designing in art and design and design and technology and does the process of designing automatically lead to creativity? Jacob Bronowski in 1973 described designing as the creative process that visualises the future, plans and represents it as images that are projected and move about inside the head. In education designing is described by Archer, Baynes and Langdon (1976) as cognitive modelling and as 'the task of creating the form of something unknown, the ability to image, to see in the minds' eye' (Baynes, 1989, p2). Educational writers (Kimbell & Perry, 2001; Mawson, 2003) agree that this process underpins and lies at the heart of design and technology. A definition of creativity argues that either 'a product or a response will be judged as creative to the extent that a) it is both a novel and appropriate, useful, correct or valuable response to the task in hand, and b) the task is heuristic rather than algorithmic' (Amabile, 1996: 35). Similarly, as in the Robinson Report (1999: 29) it is 'imaginative activities fashioned so as to produce outcomes that are original and of value', or 'imaginative processes with outcomes that are original and of value' (Robinson, 2001: 118).

In the early days of design and technology in schools designing was described in 'simple problem solving' terms, starting with a problem and progressing through a linear sequence of steps to a solution' (Kimbell, Stables, Wheeler, Wosniak and Kelly, 1989: 18). The Interim Report (DES, 1988: 11) made it clear that the term 'the design process' should be avoided as industrial, graphic, product, system and environmental designers do not work in identical ways (Buchanan, 2000). Other views were that designing is a cyclic, iterative, circular loop of phases or steps (Fasciato, 2002: 33), a form of systematic problem solving, finding a solution and integrating the procedural aspects of design with the structural aspects of design problems or an interactive process that is heuristic rather than algorithmic that can be adapted to the particular requirements of a task (Cross, 2000). It was the work of Schön (1991), based on a constructivist view of design as a process of 'reflection-in-action', that was developed in education (Kimbell, Stables and Green, 1996). The interactive, loop or circle including 'thought and action', based on the practices of professional designers, is the one favoured by design and technology in schools. It emphasises that evaluation of the end product is not an end in itself, as it may provide new problems to start the cycle again (Kimbell, Stables, Wheeler, Wosniak and Kelly, 1989).

However, there is an issue of whether the activities and abilities of many professional designers mirror the practices of pupils, as novice designers, in the conditions and constraints of a design and technology classroom (Barlex, 2007). In the National Curriculum designing is combined with the making process and it is not seen as generating an aesthetic pattern, for example in fabric, surface design or a sketch of an object (Owen-Jackson, 2002). Though, pupils design but do not make in the Young Foresight Project, where a project focuses on designing, rather than making, allowing pupils to take more risks and be more creative (Young Foresight, 2002 www.youngforesight.org). Designing when integrated with making has synergy with the 'craft' base of the master builders of medieval cathedrals, which were designed and built over a period of many years (Naughton, 1986, 1994).

In the 2007 revised Key Stage 3 design and technology programmes of study, *designing* continues to be combined with making as a key concept. However, in art and design 'designing' is included along with investigating, analysing and reflecting within the key concept of *competence*. The explanatory notes indicated that it includes designing for different purposes and vocational and work-related practice. *Creativity* in both subjects is considered as a distinct key concept with no explicit link made between designing and creativity. Overall, in design and technology the pupils 'design products and produce practical solutions that are relevant and fit for purpose' (QCA, 2007: 52). On the other hand, the outcomes for pupils in art and design are less 'definitive' and more varied. They produce 'imaginative images, artifacts and other outcomes that are both original and of value' (QCA, 2007: 18). http://curriculum.qca.org.uk/.

A brief review of the design and technology and art and design Key Stage 3 schemes of work based on the 1999 National Curriculum Orders (DfEE, QCA, 1999 a and b) illustrate differences in the range of teaching strategies and intended outcomes. In art and design units are based on the development and communication of personal views and perceptions and have varied, potential outcomes. These include 'self image', where pupils explore their

personal identity; 'change your style' where they explore contemporary design and synthesise these into new creative forms, which may be woven textiles, a ceramic form, a three-dimensional construction or body adornment; 'life events' where they explore ideas and feelings about an event in their own life as the starting point for image making; 'objects and view points' where they explore familiar objects from different viewpoints and 'shared views' where groups of pupils explore and use natural and other materials to construct a temporary, site-specific work. Some are related to pupils' direct observations of the environment, for example 'what's in a building?' where they look at the work of architects, designers and sculptors; 'recreating landscapes' and 'personal places, public spaces' where they explore examples of public art in their local area and collaborate with others to make a mural or a three-dimensional form for a specific location. Others have a more concrete focus, for example 'visiting a museum, gallery or site', or 'animating art' that explores the use of the moving image to communicate ideas.

In design and technology the units focus on producing a prescribed product by 'designing and making' and 'developing knowledge and understanding' in resistant materials, textiles and food. Intended outcomes include salads and soups; a carrying device; a safety garment or accessory; snacks; a garment or accessory for a teenage fashion show and an interesting gift or puzzle to go inside a box. In 'exploring materials' pupils focus on identifying suitable materials taking into account appearance, function, safety and reliability; they design, print or dye a piece of fabric to make into a product for sale by an environmental group; design and make a layered chilled dessert or a ready-prepared meal. When 'designing for clients' they redevelop an existing food product; develop a torch that uses a membrane switch that can be stored in a personal organiser or a wallet. In 'using control' pupils produce a display that communicates clearly and uses the simple control of movement, light or sound. In 'using information and communications technology (ICT)' and 'using ICT to support their research' they use ICT to research and plan their making and make products through computer-aided manufacture (CAM).

A new set of case studies for art and design and design and technology reflect the changes in revised programmes of study for Key Stage 3 (QCA, 2007).
http://curriculum.qca.org.uk/key-stages-3-and-4/curriculum-in-action/casestudies
In art and design case studies focuses on the work of two abstract painters and pupils' carryout open-ended research and investigations into images from landscapes and take risks to develop imaginative and original pieces. They are given the opportunity to teach art and design to residents at an old people's home and young children in the local community and work in enterprise and work-related contexts. There is an emphasis on contemporary practice and a multi-disciplinary approach. In design and technology the pupils, as a cross-curricular transition unit from primary school, plan and host a party for local pensioners. They design and make an electronic cat that mimicked human behaviour in a fun, exciting way. Creativity and flexibility is a focus in one case study that merged the design, development and modeling phases to strengthen pupils' decision making. In another school pupils explore, experiment, make informed choices and take risks with ingredients to produce creative and innovative outcomes. They design a healthy soup using seasonal local produce taking into account environmental, ethical, economic and social dimensions of designing and learning about genetically modified (GM) foods and 'air miles, and the 'carbon footprint'.

The examples cited above show that in design and technology for some schools there has been a move away from the tightly focused, functional outcomes noted in the schemes of work (DfEE, QCA, 2000b) and the research project outlined in this paper to take into account more varied outcomes. When considering contrasting perceptions and responses, it can be argued that design and technology has in the past been more instrumental than art and design. For example, increased aesthetic insight gained from personally significant entries in a sketch book were quite legitimately seen as a successful art and design experience in its own right, whereas in design and technology unless such an exploration led to an outcome that could be used and evaluated from a variety of perspectives, it was seen as wanting. The existence of an industrial production and commercial practices statement in the design and technology programme of study without an equivalent art and design statement is significant in underlining the instrumentality of design and technology (DfEE, QCA, 1999c).

In summary, it can be said that experiences in the art and design curriculum essentially develop pupils by helping them to perceive and respond to that which is already present, or developing, within themselves. This is in contrast to experiences in the design and technology curriculum, which focuses on developing the pupils by helping them to perceive and respond to influences outside themselves such as the needs and wants of others, utilisation of technologies and market opportunities. Creativity has long been seen as an essential element in art and design and teachers have developed and used a range

of strategies to motivate pupils to explore and investigate to develop a range of potential outcomes. This has been in contrast to design and technology where projects and pupils' designing, especially at Key Stage 3, was frequently restricted focusing on functional and utilitarian outcomes. The three feature model outlined in this paper is a useful tool for analysing and supporting pupils' creativity and the design pentagon is a useful framework for pupils to widen and strengthen their decision making. It can be particularly helpful for average and lower ability pupils who may be 'frustrated by abstract teaching of designing and evaluation' (Ofsted, 2008: 6).

It is argued in this paper that designing as a creative activity used by professional designers, includes the three phases of analysis, synthesis and evaluation and is a combination of procedural and conceptual knowledge (de Vries, 2005). However, there is an issue of whether pupils, as 'novice' designers, can rely solely on learning the process of 'designing' to ensure their creativity potential in the context of a school classroom. Creativity occurs when a number of dimensions coincide, sometimes known as 'the creativity intersection' (Amabile, 1989: 63). The features that are necessary for creative activity include sound domain, subject knowledge and skills, process relevant features including designing as an interactive, iterative creative problem solving heuristic process. In order to achieve this complex concept a pupil will need to develop vision, confidence, a willing to take risks, motivation and be proactive and an independent thinker. Teachers will be required to plan interesting, open-ended schemes of work in relevant contexts, using a range of strategies to motivate, empower and help develop appropriate skills. They need to give pupils opportunities for 'dwell' time to reflect and collaborate with their peers. The social environment, or the classroom, is a key factor and it must be supportive, rewarding, secure and conducive to risk taking, the development of peer relationships and the effective use of space and resources. 'Blurring the boundaries' is a positive step forward and this can be achieved through collaboration between teachers of art and design and design and technology. This has the potential to support and improve creativity in design and technology, within the context of appreciating and understanding the similarities and differences of the subjects and their individual identities.

References

Amabile, T. (1983) *The Social Psychology of Creativity*, New York: Springer-Verlag.

Amabile, T. (1989) *Growing up Creative: Nurturing a Lifetime of Creativity*, New York: The Creative Education Foundation

Amabile, T. (1996) *Creativity in Context: Update to the Social Psychology of Creativity*, Colorado, USA: West View Press.

Archer, B., Baynes K. and Langdon, R. (1976) *Design in General Education*, London: Department of Education and Science

Arts Council (2008) *What people want from the arts*, Arts Council England: London

Barlex, D (2003a) 'Creativity in Art and Design and Design and Technology in the National Curriculum' An Exploration commissioned by the Qualifications and Curriculum Authority (QCA): London.

Barlex, D. Ed. (2003b) '*Creativity in Crisis?*' Nuffield Foundation, Design and Technology Association, Wellesbourne: The Design and Technology Association.

Barlex, D. (2007a) 'Assessing capability in design and technology: the case for a minimally invasive approach' in *Design and Technology: An international Journal, Vol 12.2*, The Design and Technology Association: Wellesbourne

Barlex, D. (2007b) 'Capitalising on the Utility embedded in design and technology activity: an exploration of cross-curricular links' in *Linking learning: The Design and Technology Association International Research Conference 2007,* University of Wolverhampton, 4, 5, 6 July 2007: 5-10

Barlex, D. (2007c) 'Creativity in school design and technology in England: a discussion of influences', *The International Journal for Technology and Design Education*, 17: 149-162.

Baynes, K. (1989) 'Beyond Design Education', *Journal of Art and Design Education*, Vol.1, No 1, 1989.

Buchanan, R. (2000) 'Wicked Problems in Design Thinking' in Margolin, V, Buchanan, R., *The Idea of Design*, Cambridge, Massachusetts, The M.I.T.T. Press.

Csikszentmihalyi, M. (1994) 'The domain of creativity', in Feldman, D., Csikszentmihalyi, M. and Gardner, H. Changing the World: *A Framework for the Study of Creativity*, West Point Connecticut: Praeger.

Cross, N. (2000) *Engineering Design Methods Third Edition*, Chichester: John Willey

Art and Design and Design and Technology: Is there creativity in the designing?

De Vries, M. J. (2005) *Teaching about technology: An introduction of the philosophy of technology for non-philosophers*, The Netherlands, Springer.

DES (Department of Education and Science/Welsh Office) (1988) *National Curriculum Design and Technology Working Group: Interim Report: The Parkes Report,* London: HMSO

DES (Department of Education and Science) (1990a) *The National Curriculum*, London: HMSO

DES (Department of Education and Science) (1990b) *Art in the National Curriculum*, London: HMSO

DES (Department of Education and Science) (1990c) *Technology in the National Curriculum*, London: HMSO

Department for Education and the Welsh Office (1991 and 1992) *Design and technology in secondary schools HMI Reports*: DES: London

DfE (Department for Education), (1995a) *The National Curriculum,* London: HMSO

DfE (Department for Education), (1995b) *Art in the National Curriculum*, London: HMSO

DfE (Department for Education), (1995c) *Design and Technology in the National Curriculum*, London: HMSO

DfEE (1999) *All our futures: creativity, culture and education*, Department for Education & Employment: London

DfEE and QCA (1999a) *The National Curriculum for England*, London: HMSO

DfEE and QCA (1999b) *Art and Design: The National Curriculum for England*, London: HMSO

DfEE and QCA (1999c) *Design and Technology: The National Curriculum for England*, London: HMSO

DfEE and QCA (2000a) *Art and Design: A scheme of work for key stage 3 and 4*, London: HMSO. http://www.standards.dfes.gov.uk/schemes2/secondary_art/art07a/?view=get

DfEE and QCA (2000b) *Design and Technology: A scheme of work for key stage 3 and 4*, London: HMSO http://www.standards.dfes.gov.uk/schemes2/secondary_dt/?view=get

Fasciato, M. (2002) 'Designing - what does it mean at Key Stage 2 and 3?in Sayers. S., Marley, J. and Barnes, B. *Issues in design and technology teaching*, London; Routledge Falmer.

Feldman, D., Csikszentmihalyi, M. and Gardner, H. (1994) *Changing the World: A Framework for the Study of Creativity*, West Point Connecticut: Praeger.

Hughes, A. (1998) 'Reconceptualising the Art Curriculum' in *Journal of Art and design Education*, Vol. 17, no 1.

Kimbell, R., Stables, K., Wheeler, T., Wolziak, A. and Kelly, V. (1989) *The Assessment of Performance in Design and Technology*, London: School Examinations and Assessment Council/Central Office of Information

Kimbell, R., Stables, K. and Green, R. (1996) *Understanding Practice in Design and Technology*, Buckingham: Open University Press

Kimbell, R. and Perry, D. (2001) *Design and Technology in the knowledge economy*, London: Engineering Council

Mawson, B. (2003) 'Beyond 'The Design Process': An Alternative Pedagogy for Technology Education', in *International Journal of Technology and Design Education* Vol. 13, pp. 117-128

Murphy, P. (2003) 'The Place of Pedagogy' in *Creativity in Crisis*, Barlex, D. Ed: Nuffield Foundation, The Design and Technology Association, Wellesbourne

Naughton, J. (1986) 'What is 'technology' anyway?' in *Technology in Schools*, Cross, A. and McCormick, B. Milton Keynes: Open University Press

Naughton, J. (1994) 'What is 'technology?' in *Teaching Technology*, Banks, F, London: Routledge

Ofsted (1998). *Secondary Education 1993-97: A Review of Secondary Schools in England.* The Stationary Office, London

Ofsted (2008) *Education for a technological advanced nation: design and technology in schools 2004-07,* Ofsted: London

Owen-Jackson, G. (2002) 'Teaching and Learning about Design', in Owen-Jackson, G. *Aspects of Teaching Secondary Design and Technology London*: Routledge Falmer

Penfold, J. (1988) *Craft, Design and Technology: Past, present and future*, Stoke-on Trent: Trentham Books

QCA (Qualifications and Curriculum Authority) (2007) Programmes of Study for Key Stage 3 http://curriculum.qca.org.uk/

QCA (Qualifications and Curriculum Authority) (2008) Case studies http://curriculum.qca.org.uk/key-stages-3-and-4/curriculum-in-action/casestudies

Steers, J. (1997) *Some questions about the future of art and design education*, an unpublished article, 4th Revised draft 17.12.1997.

Rutland, M. (2003) 'How do we show in design and technology that we value creativity?' PATT-13 *(Pupils' Attitude Towards Technology) International Conference, 'The place of design and technology in the curriculum'*, University of Glasgow, Scotland, June 2003, pp 71-83, www.iteaconnect.org/PATT13/rutland.pdf

Rutland, M. (2005) *Fostering creativity in design and technology at Key Stage 3*, unpublished PhD thesis, School of Education, Roehampton University, University of Surrey.

Rutland, M. (2007a) 'The place of creativity in technological literacy: the role of teaching resources in fostering pupils' creativity', *PATT-15 (Pupils' Attitude Towards Technology) International Conference,* Glasgow, Scotland, June 2007, pp 313-323 http://www.iteaconnect.org/Conference/PATT/PATT18/fullprog-23-53b[1].pdf

Rutland, M. (2007b) 'Developing the design decisions pentagon' *unpublished teaching materials.*

Rutland, M. and Barlex, D. (2002) 'The relationship between art and design and design and technology in the English curriculum with reference to creativity', in *Technology Education in the Curriculum: Relationships with Other Subjects, PATT-12 International Conference,* Columbus, OHIO, USA www.iteaconnect.org/PATT12/rutland.pdf

Rutland, M. and Miles-Pearson, S. (2007) 'Auditing design decisions in food technology: experiences of initial teacher primary design and technology students' in Benson, C., Lawson, S., Lunt, J. & Till, W. (eds) *CRIPT: 6th International Primary School Design & Technology Conference: Ten Years On*, Birmingham: England.

Rutland, M. and Spendlove, D. (2007) 'Creativity in Design and Technology' in *Design and Technology: for the next generation*, Barlex, D. (Ed.) Whitchurch: Cliffe & Company

Rutland, M. and Barlex, D. (2008) 'Perspectives on pupil creativity in design and technology in the lower secondary curriculum in England' in *The International Journal for Technology and Design Education*, 18: 139-165.

Schön, D. (1991) *The Reflective Practioner*, Aldershot, England, Avebury Publishers

Sillitoe, H. (1966) *A History of the teaching of Domestic Subjects*, London: London Metheun

Young Foresight (2002) www.youngforesight.org

Websites accessed:
http://openlearn.open.ac.uk/mod/resource/view.php?id=167577. – accessed 25.11.08

http://curriculum.qca.org.uk/ - accessed 25.11.08

http://www.educationfutures.org.uk/young_foresight.asp - accessed 05.12.08

m.rutland@roehampton.ac.uk