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## **Creativity: is it on the Key Stage 3 (11-14 years) design and technology (D&T) agenda?**

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Rutland, Marion. 2019. "Creativity: Is It on the Key Stage 3 (11-14 Years) Design and Technology (D&T) Agenda?". figshare. <https://hdl.handle.net/2134/2883>.

# Creativity: is it on the Key Stage 3 (11 -14 years) Design and Technology (D&T) Agenda?

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## Abstract

The paper looks at part of an on going research project into creativity in D&T, with specific reference to lower secondary Key Stage 3 curriculum (11-14 year old pupils) in England. The key research question is 'to what extent is it possible to change the direction of design and technology education in the classroom through highlighting creativity?'

This paper focuses on the sub-research question: 'what is likely to be the present position regarding the development of creativity in the Key Stage 3 (11-14 years) classroom?' A 'naturalistic', overt, semi-structured observational study, that is a study in a 'real' setting with an agenda of issues, is used to collect data to clarify and illustrate issues or features through the technique of 'participant-as-observer'. It is school-based case study of a Year 8 D&T class in a series of lessons in two D&T focus areas. The D&T lesson observations focused on the role of the teacher in providing the potential for creativity and the pupils' responses. The findings are mapped against criteria within a three-feature model of creativity, drawn from a literature review and earlier data collection activities. The analysis provides some evidence of the present situation regarding the development of creativity in the classroom and adds to the debate regarding the development of creativity in D&T.

**Key words:** D&T, creativity, Key Stage 3 (11-14 years), classroom, case study, 'participant-as-observer'.

## Introduction

This paper reports on one aspect of a research project into creativity in D&T, with specific reference to the lower secondary Key Stage 3 curriculum (11-14 year old pupils) in England. The research is based on the hypothesis that creativity in D&T is not a spontaneous, sustained process for many pupils in the early years of secondary schooling and that teachers can play a major role to enhance creativity in classroom activities. The need to develop pupils' 'creativity' is now a key issue in the UK. The report *All Our Futures: Creativity, Culture and Education* (Robinson, 1999) argues for a national strategy for creative and cultural education and recent government initiatives have emphasised the need to develop creativity across the curriculum (DfEE,

QCA, 1999). Writers have highlighted the importance of creativity in education (Hargreaves, 2000, Kimbell, 2000):

'As creativity is now acknowledged as an essential feature of D&T it is important to explore the reality of the subject in the secondary school classroom to find out if indeed there is a crisis in creativity' (Barlex, 2003).

Initially, in this study a literature review explored the general concept of creativity to develop a model or framework that could be used to analysis collected data. Defining creativity in general terms is not an easy process. Some writers see levels of creativity. Big creativity is when something of enduring value is contributed to an existing field of knowledge, which transforms it. Small creativity is more humble, though perhaps equally valuable, activity giving a fresh and lively interpretation to any endeavour (Feldman, Csikszentmihalyi, Gardner, 1994). Boden (1994) refers to small changes (a tweak) or larger changes (transformational).

Traditionally, creativity has been viewed through the person (Gardner, 1993). Other writers see it as a process or system (de Bono, 1992), or the product (Gardner, 1993). Sternberg & Lubart (1999) combine process with product and Amabile (1983, 1996) highlights the impact of specific social factors and intrinsic motivation on creativity. Recent studies on creativity hypothesise that multiple components must converge for creativity to occur (Amabile, 1983, 1996; Csikszentmihalyi 1990, 1996; Feldman et al, 1994; Gardner 1993; Sternberg and Lubart 1995, 1999). A three-feature model for creativity in an educational setting was developed for this research study based on the literature outlined above. The model consists of domain relevant features: a set of practices associated with an area of knowledge; creativity-relevant features- influencing, controlling the direction and progress of the process; and social, environmental features - macro/micro environmental, social and cultural issues. The element of person, or child, is central to the model as it reflects the influences of the three features on the creativity of the child (Rutland, 2002).

A pilot study explored the sub-research question 'what should creativity in the school curriculum,



including D&T look like?’ through the findings of the UK joint Nuffield Design and Technology Project and QCA project ‘Creativity in Art and Design and Design and Technology’. The development of technical creativity was found to be generally the main focus for D&T teachers, especially in the lower secondary school. Choice and decision making and being creative were not key issues. Key factors for D&T was the frequent setting of restrictive design brief and teachers who did not appear to appreciate their role in creating an environment in the classroom where children are confident and able to take risks in their designing and making (Rutland, 2003a).

The focus of this paper is the sub-research question ‘what is likely to be the present position regarding the development of creativity in the Key Stage 3 (11-14 years) classroom?’ The aim was to assess the situation in a natural, unaltered setting (Adams, Schvaneveldt, 1991).

### **Methodology**

A case study was used as the main research tool with a ‘naturalistic’, overt, semi-structured observational study, which is a study in a ‘real’ setting, with an agenda of issues where data is collected to clarify, illustrate these issues or themes (Cohen et al, 2001). In naturalistic inquiry the ‘human’ or researcher is the main form of data collection (Tesch, 1990). In this case study, the pupils in school knew the researcher because she regularly observed trainee teachers’ lessons. The approach taken in this study is the participant-as-observer as discussed by Burgess (1985). This situation could be described as ‘soft’ or non-interventional, in that the observer/researcher is in the room, watches the lesson, moves around the classroom, but does not take part or intervene. The observations were ‘overt’ because the teacher and the pupils were aware that the focus of the observation was creativity and that data was being recorded for research (Cohen et al, 2001). The case study ran over a six-month period from initial contact in the summer of 2000 with the school, pupils and teachers.

An urban, mixed comprehensive school for pupils aged 11-16 years was approached to take part in the study. It was agreed that the researcher would study a mixed ability D&T Year 8 class with seventeen pupils, nine boys and eight girls, taught by two teachers in two of their D&T focus areas: systems and control and food technology. The school provided data on the class, including the pupils’, previous experiences in D&T in Year 7 and the teachers discussed the units of work that were to be taught. In Year 7, 8 and 9 all pupils had experienced a teaching unit of resistant materials, food and textiles technology and systems and control on a

carousel basis. Four pupils were identified to be interviewed at the end of the study together with the two teachers. The pupils represented the ability and gender balance in the class.

Structured observations were used. A framework for the analysis of the lesson observations and teacher and pupil interviews was structured based on the three-feature model for creativity developed from the literature review and the findings from interviews with professional designers (Rutland, 2002) and colleagues from large engineering aeronautical company (Rutland, 2003b). Specific criteria were located in each of the three features for recording data against teacher and pupil activities.

In the second half of the Autumn term of Year 8 the first unit of work (a) focused on systems and control. It was called ‘The Grabber’ and was made up of seven sessions based on mechanisms and pneumatics, building on an electronics and control unit ‘Crocodile Clips’ taught in Year 7. In the early sessions the pupils learn about and modelled types of levers and pneumatic systems using syringes and tubing. They then develop, made and tested their own ‘grabber’. The second unit (b) focused on food technology and consisted of two parts. The first five weeks was a series of lessons looking at ‘the functions of ingredients/packaging and labelling’ and included a wide range of practical activities. The second four weeks focused on the developing a product for a ‘healthy lunch box’. This unit extended the ‘pizza’ Year 7 food technology unit based on basic nutrition and food preparation.

### **Results**

#### **A**

##### ***Domain relevant features:***

set of practices associated with an area of knowledge.

##### ***Concept/idea***

in unit (a) the brief was set by the teacher in a realistic setting through modelling a pneumatically driven processing machine in ‘Mars bar’ factory. It focused on functionality with very limited opportunity for pupil originality. In unit (b) the context encouraged a variety of types of lessons and encouraged originality e.g. choice of ingredients and the product for the lunch box.

##### ***Aesthetic***

In unit (a) the only reference to aesthetics was the teacher directive to develop a simple design and use minimal materials. In unit (b) the pupils were required to consider appearance (chocolate, nuts decoration), flavour (grill cheese), smell, texture (lettuce and cucumber), colour (green vegetables) and personal, emotional preferences.



### **Technical**

The teacher in unit (a) emphasised knowledge and understanding of mechanism e.g. types of levers, and pneumatics (air) through the use of syringes. The pupils were required to apply this when sketching in course booklet, modelling ideas to develop and make their final 'grabber' design. Unit (b) also emphasised technical knowledge and understanding of food as a material for pupils to make design decisions. For example, ingredients to thicken, strengthen and stabilise structures (eggs, flour) and baking powder to make things. Pupils used this effectively to make a wide range of design choices in their food products.

### **Constructional**

In unit (a) the teacher taught knowledge of mechanisms and demonstrated the product analysis activity e.g. examples of mechanisms. Pupils used tools and equipment when trying out ideas and making their final design prototype. In unit (b) the teacher did 'spot' demonstrations for skills as and when they were necessary. The pupils carried out product analysis activities e.g. on varieties of crisps, packaging materials and made a range of products. They used a variety of tools and equipment and processes to make a pasta sauce based product, a chilled dessert and product of their own specification for a healthy lunch box.

### **B**

#### **Process relevant features**

influencing, controlling direction/progress of the process.

#### **Creative problem solving**

The teacher set a semi-open brief in unit (a). The pupils watched a demonstration and were asked to find examples of pneumatics and hydraulics for homework. They were encouraged to try out ideas, use different techniques, test and modify to solve the set problem. In unit (b) the teacher set the scene, provided a framework and allowed pupils to work through a series of activities each week. Pupils observed, investigated, evaluated, synthesised, developed ideas, evaluated and modified ideas e.g. classification of foods according to functionality, use, taste and chose ingredients for each lesson. They developed recipes, tested factors such as consistency and used a variety of processes e.g. cakes, biscuits, salads.

#### **Organisation**

In unit (a) the teacher planned the lessons using a range of teaching strategies including demonstration, brainstorming, small group work, individual work and allowed 'incubation' or dwell time for homework. Analysis and self-organisation by

pupils was encouraged. In unit (b) the teacher planned each lesson, organised pupils into groups, set time targets, encouraged group brainstorming and wrote a flow chart on the board. Pupils were self-organising for their ingredients and equipment and they were required to synthesise, incubate and develop their ideas between lessons.

### **Personal**

in unit (a) the teacher set the brief in an interesting context, set time targets and periods of silence to encourage pupil concentration. Pupils worked individually or in groups and the teacher supported when necessary. Pupil concentration was good during the competition. Unit (b) the teacher set up activities and encouraged pupils to share, work in pairs, teams and individually. The pupils were proactive, independent and one was particularly noted for a willingness to take risk e.g. in their choice of product to develop.

### **C**

#### **Social/environmental features**

social, cultural influences macro/micro-environment.

#### **Background**

unit (a) built on the pupils' previous school experience in Year 7 and the homework drew on home experiences. In unit (b) the pupils related their lessons to previous experiences at home e.g. family and peers and a Year 7 unit of work.

#### **Use of external/transferable knowledge, understanding and skills**

There was evidence in the lessons of unit (a) of the key skills of collaboration, communication, numeracy (measuring materials) and literacy. Pupils talked, wrote about, sketched, measured and recorded their designs. In unit (b) there was evidence of literacy (reading instructions, writing/recording in booklets) and numeracy (measuring ingredients). Problem solving of a brief was present in both units, but there was no evidence of ICT in either.

#### **Handling outside/conflicting constraints**

the teacher and pupils in both unit (a) and (b) were aware of an observer in the lesson. Pupil groups were arranged in both by the teacher and as were the constraints of a school assessment scheme. In both units there was a need to work as a team with peers and sharing resources. Pupils in unit (b) were expected to provide ingredients for the lesson and were made aware of other peoples' likes and dislikes.

#### **Appreciation of alternative ideas and experiences**

The brief in unit (a) related to the world outside school and pupils were required to listen to and worked with





peers. No links were made with other subjects. In unit (b) pupils made stronger links with other subjects e.g. science (starches, melting fat, thickening).

### **Motivational**

in unit (a) the teacher provided extrinsic motivation through an industry related brief, praise, clear lesson targets, completion of a course booklet, assessment through a class competition (reward of Mars bar) and the school assessment scheme. Intrinsic pupil motivation was not evident. In unit (b) there was a combination of extrinsic motivation from the teacher and the security of using basic recipes. Intrinsic motivation opportunities were available for pupils through the choice of ingredients and the development of their own specification for the lunch box. Books, videos and samples were used to stimulate ideas.

### **Environmental**

in unit (a) there was a supportive, rewarding environment but limited equipment and the need to dismantle their models after each session restricted the pupils. There were good peer relationships. Risk taking was restricted to some extent by a wish to 'win' the competition and the school assessment scheme. In unit (b) there was a calm, working environment where pupils could listen to each other and think. There was a good range of resources within a secure environment. Pupils worked in groups and individually and were made aware of peers' ideas and values.

### **Discussion**

The results are based on a case study of one Year 8 class and two units of work in one school. It provides some evidence of the present situation regarding pupils' creativity in D&T at this age range in the UK to add to the debate regarding the development of creativity. Within the context of this case study, it indicates criteria in the three features model that are likely to be present in the classroom and others that could be further developed in the quest for creativity.

It was found that the setting of a brief for D&T is a crucial factor. Unit (a) had a realistic setting, making links with the outside world, but it did not provide the potential for pupils to be creative. The focus on functionality and one type of mechanical outcome over a period of weeks did not allow pupils to show originality or any form of novelty. The early lessons were closely structured with limited opportunities for design decisions. Some creativity was possible when the pupils developed their own 'grabber', but these were limited by resources and to some extent time. The range of teaching strategies and activities used in unit (a) were limited, though the situation was better in unit (b) which included a range of different tasks and activities to build knowledge and understanding.

There were opportunities to make design decisions before the pupils were required to develop, or create, their own product. Aesthetic considerations were very limited in unit (a) but well covered in unit (b). It is likely that evidence of certain criteria will vary across focus areas of D&T and age phases. However, the findings indicate that there were lost opportunities for interesting and motivating activities, especially in unit (a). Technical and constructional factors were covered well in both units of work.

The findings indicate that the quantity and quality of creative problem solving is directly influenced by the brief set by the teacher and the lesson by lesson structure of the unit. There is a need for a balance between developing knowledge, understanding and skills and providing opportunities to work in a heuristic way, allowing pupils to make their own decisions. Briefs, such as 'The Grabber', are problem solving but in this case decision making lay mainly in the hands of the teacher rather than the pupil. Classroom organisation by the teacher in D&T was a strength in both units and pupils were encouraged, especially in unit (b), to develop the skills of self-organisation. Group work was used in both units, though they were mainly teacher-directed. Incubation, 'dwell time' to think or reflect was evident in unit (a) but not well developed, with more opportunities noted in unit (b). In both units the teacher was the key factor in influencing pupils to be, for example, to be tolerant, take risks and be pro-active.

There was limited reference in both units to previous personal or educational experiences and links with other subjects, though they are stronger in unit (b). There was evidence of the use of transferable skills, through the use of information communication technology (ICT) was missing from both units. Assessment, and the need for high grades, appeared to hinder pupil willingness to try out new ideas. There was little evidence of intrinsic motivation, as it was the teacher and school that provided a range of extrinsic, motivational practices. There was limited use of stimuli as starting points to interest and motivate, especially in unit (a). In both units the emphasis was on the teacher to provide a secure, rewarding, supportive, well-resourced and safe classroom environment where pupils were encouraged to take risks, work co-operatively and be creative.

### **Conclusions**

Though this is a case study in one school there are indications of key factors that are needed to encourage the development of creativity in D&T factors at this age range. The weaknesses noted in the case study reflect the findings of Rutland (2003a) and the views expressed by Parker (2003). Key issues are the setting of a realistic, intrinsically motivating brief with the potential for creative



problem solving, reflection and pupil decision making. Considerations when structuring the series of lessons include progression, links with other subjects, access to and use of stimulating resources, using a range of teaching strategies, including independent learning and group work, and a balance of aesthetic, technical and constructional criteria. The role of the teacher in developing the potential of their pupils' latent creativity is crucial. The importance of classroom and curriculum organisation and management, including a calm, supportive environment conducive to confidence and risk taking, by the teacher has resonance with Amabile (1983, 1996), who argues that these are the factors that can maintain or kill creativity and motivation. The next task of the research study is to begin to explore the range of teacher strategies that could be used in the D&T classroom to enhance pupils' creativity.

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