

**Title:** A Preliminary Study of an Attempt to Introduce PGCE D&T Students to Designing and the Teaching of Designing in the Secondary School

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This paper will summarise the evidence concerning design performance in the secondary school design & technology curriculum and relate this to the subject construct model developed by Open University and utilised in the DEPTH (Developing Professional Thinking for Technology Teachers) Project. The paper will describe the work carried out by PGCE Design and Technology students at University of Surrey Roehampton that was devised specifically to give them experience relevant to their own development as a designer and how this might be related to developing design skills in school pupils. The paper will close by relating the work carried out by the students to their professional development in terms of the DEPTH model of subject construct and describing the follow up research that will be carried out in response to these initial findings.

**Title:** Remembering the C in D&T: Gendered Perceptions of Creativity and Design & Technology.

**Author:** David Spendlove

With an increasing interest (NACCCE) and emphasis on creativity through QCA, national initiatives such as creative partnerships (£40 million) and Nesta young foresight project, and with the subject of design and technology having creativity identified twice in its National Curriculum statement of importance, the relationship of creativity and design and technology is explored. In addition, this small-scale research across five secondary schools also explores pupils' gendered perceptions of creativity in the curriculum and gendered perceptions of creativity in the design and technology curriculum.

The gendered perceptions of pupils is considered important in attempting to gain a further insight into the differential performance of boys and girls within D&T, which currently has one of the largest gender gaps of all subjects.

The paper will explore: -

- Defining creativity.
- Creativity and design and technology.
- Pupil perceptions of creativity.
- Pupils gendered perceptions of design and technology and creativity in the curriculum.
- Pupils gendered perceptions of creativity and the design and technology curriculum.

**Title:** Innovation in Design and Technology: the Polymer Acoustic Guitar and the Case for the Relegation of ‘The Design Process’

**Author:** Eddie Norman, Department of Design and Technology, Loughborough University

Innovation and creativity are becoming anticipated aspects of successful design and technological educational activities and teaching, learning and assessment strategies that facilitate innovation and creativity are at the heart of many current debates. The author of this paper was awarded an Invention and Innovation Fellowship by NESTA (National Endowment for Science, Technology and the Arts) in November 2001 to pursue the development of the polymer acoustic guitar, and jointly with Dr Owain Pedgley, a HEROBC Regional Innovation Fellowship in July 2002 and a Gatsby Innovation Fellowship in January 2003 to continue this work. The paper will explore some aspects of the demands being made on students and teachers in relation to innovative project work, by considering the design and development of the polymer acoustic guitar. In particular, some aspects of design epistemology (ways of knowing that facilitate designing) will be discussed using evidence from this project, for example, the supposed tension between ‘craft skills’ and ‘modern technology’.

Guitars are essentially archetypes in the sense described by Thistlewood (1990), in that their *essential* form is largely fixed. The role of the designer in relation to archetypes is restricted to paying attention to materials, colours and decorative treatments. The design development of the guitar has also been characterised by evolutionary spurts associated with particular guitar makers (eg Antonio de Torres and the Spanish classical guitar and Leo Fender and the solid body electric guitar). In these respects, the design development of guitars is not too far removed from the project work typically undertaken in schools and colleges in order for parallels to be drawn and the nature of design innovation to be explored.

The knowledge, skills and values relating to design and technology were identified and classified in work done by the Assessment of Performance Unit in 1982. In the early 1980s, this was an emerging area of discussion (eg Cross (1982)), but much subsequent debate has focussed on, at best, ‘design processes’ and, at worst, ‘the design process’. This has led to both unrealistic and ill-founded expectations concerning designing as a transferable skill, and the neglect of the development of understanding concerning the knowledge, skills and values that underpin

designing in particular areas. As the rhetoric of designing as a transferable skill has developed, it has been possible to find writers suggesting that there is no knowledge for designing (rather than no fixed knowledge base, which is clearly true). A model of design and technology emphasising the role of knowledge, skills and values, and excluding any reference to a process or processes, was presented at the DATA Millennium conference (Norman, 2000). The paper will conclude by discussing why such a model is a superior starting point for discussing teaching, learning and assessment strategies for design and technology in relation to creativity and innovation.

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**Title:** The Introduction of Practical Craft Skills into the Scottish Technology Curriculum: A New Beginning or the Beginning of the End.

**Author:** John Dakers, Lecturer in Technological Education, Glasgow University

A new subject has entered the technology curriculum in Scotland in the form of 'Practical Craft Skills'. This has been met with a large degree of satisfaction from the majority of technology teachers in Scotland who have been showing a growing concern about the ability of certain pupils to deal with the design element in Craft and Design.

The 'arranged marriage' of craft to design has not been without its tensions as the long established craft tradition had to make accommodations to its new more creative partner. The teaching of design, its assessment, and its integration with craft skills has not as yet found an optimum balance in technical education in Scotland and this has left a proportion of students not entirely convinced of the benefits of the design dimension. Courses in Practical Craft Skills have no design element, are continually assessed and are inherently skills based. This 'skills by prescription' approach is becoming entrenched in policy. Ironically, the Scottish Qualifications Authority have, paradoxically, noted some concerns that:

'In a very small number of centres candidates have been allowed to adopt a 'Craft and Design' approach to the Woodworking Skills course project. Instead of being given a standard NAB [National Assessment Bank] drawing and instructed to lift sizes on to the appropriate material and generate skills evidence accordingly, candidates have been given more freedom, to a greater or lesser extent, to introduce their own interpretations and 'do their own thing'. This of course is contrary to the spirit and letter of the instruction contained in the Subject Guide and must not continue if skills evidence is to be maximized'. (SQA. 2003)

This particular curriculum reform could therefore be interpreted as a retrospective dilution and re-vocationalisation, of the curriculum, or conversely, as a broadening out of provision which allows teachers greater scope to respond to the educational needs and preferences of diverse groups of pupils. Whilst the risks of forecasting curricular futures must be acknowledged, the trend of departments offering Practical Craft Skills alongside Craft and Design, or indeed in place of Craft and Design, looks set to continue at

the expense of design education in Scotland. (Dakers and Doherty. 2003)

This paper will seek to argue that the teaching of Practical Craft Skills as a hands-on practical activity, with no involvement in design has no value whatsoever for the pupils in question, or for the working society they are about to enter into.

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**Title:** Making Progress? A Discussion of the Concept of Progress in Relation to Design and Technology Education.

**Author:** Steve Keirl, University of South Australia

It is sometimes claimed that ‘you can’t stop progress’. The claim is often made in general conversation with reference to technological developments. *Progress*, at least in its determinist sense, seems neither stoppable nor a suitable candidate for interrogation. Against such a context, and of more focal interest, much Design and Technology Education curriculum tries to ‘keep up’ with technological trends and innovations but does so through little more than technical mimicry.

This paper sets out to clarify a variety of understandings of the concept of progress and then to examine the relationships of these to Design and Technology Education. Thus, in looking at progress, it aims to:

- present something of the history of the concept (as it has distinct historical contexts) – for example ‘The Idea of Progress’ and its roots in the Enlightenment, and the 20th Century erosion of faith in the notion
- explore the relationships of the concept with concepts such as technological determinism, technicism, optimism, pessimism, morals and happiness
- discuss determinist versus constructivist notions of progress and,
- explore differing political versions of the concept.

In the light of the above, the paper will show the contestable nature of *progress* and will illustrate the kinds of ways such a problematic concept can be a valid part of Design and Technology Education – for example: through rich understandings of design, by clarifying the nature of technological development and in questioning the ethics and ideologies of curriculum in general.

**Title:** Globalisation on the Go: Implications for Design and Technology Education @ 2003

**Author:** Steve Keirl, University of South Australia

Whatever might be meant by globalisation, it may not be what we perceive it to be. Nor may it be beyond our influence as educators. This is not to suggest that, if it is a single linear inexorable force, the nascent field of D&T education is going to halt it or change its course. Rather, this paper argues that, in recognition of the fact that something called globalisation may be happening, it is worth looking at what this means for D&T education.

The paper explores the nature of globalisation, arguing that it is neither a singular homogenous phenomenon, nor is it something towards which D&T curriculum cannot contribute. However, such a contribution begs the question of the nature and quality of the curriculum we chose to offer.

By taking a critical perspective on both globalisation (transnationals, governments, multiple global fronts, equity, culture and identity, materialism and design, etc) and on D&T curriculum, the paper sets out a variety of understandings of global forces and global alternatives and articulates a series of criteria which might be applied to an appropriate D&T education in a globalising context.

**Title:** The Wow Factor – Textiles gets a Boost with CAD in the UK and Australia

**Authors:** Rose Sinclair, Lecturer Goldsmiths College London and Louise Duvernet, Lecturer in technology, Australian Catholic University

The paper traces the introduction of SpeedStep software into secondary schools in the UK and Australia from the initial identified need for the software through to the use of the software in implementing secondary school technology and design syllabuses.

The findings have broader implications for the development of teaching strategies that engage the learner in both the design and manufacturing environment using 'the real and virtual design' environment as well as creating a new mind set for education.

In this age where students need to be involved in the creation of new knowledge, textile/fashion specific CAD software introduces them to skills directly related to industry and provides an opportunity to liaise with industry as never before.

**Title:** Interaction, Dialogue and a Creative Spirit of Inquiry.

**Author:** J. W. Hamilton, Stranmillis University College, Belfast.

The aim of Design and Technology is 'to enable all pupils to become confident and responsible in solving real life problems, striving for creative solutions, independent learning, product excellence and social consciousness' (NICC 1991:15). A main aim of the present study was to create an environment and climate for learning that would enhance design capability and problem solving. To achieve this, pupils from two Year 7 classes (mean age 11 years old) were organised into groups of four as creative learning communities. Working collaboratively and co-operatively pupils were able to discuss, clarify, brainstorm, think through their ideas, negotiate and arrive at a shared contextual understanding for their talking, thinking, planning and making. A local story was used as a stimulus for critical and creative thinking and as the platform for design and technology activity.

Methodology included digital video and audio recordings, picture capture, classroom observation, pupil and teacher semi-structured interviews, teacher logs, researcher field notes, project evaluation.

Findings showed that active participation, dialogic inquiry and careful scaffolding of the learning by the teachers, enabled pupils to achieve at a higher level than they would have done if left unassisted. Individual creativity and problem solving was enhanced, as evidenced by the high levels of pupil engagement in the process and diversity of pupil outcomes. Purposeful pupil talk and a creative spirit of inquiry were significant in the teaching-learning process. As technologists, pupils were learning how to learn and thinking how to think within a context that was real and of interest to them.

**Title:** Technology Students' Views of Intelligence and the Implications for Classroom Practice

**Author:** Wendy J. Dow

This paper explores the views of intelligence held by two groups of students studying for the degree of Bachelor of Technological Education (B.Tech.Ed) at a Scottish University. The views of a group of first year students are compared to a group of students who are in the fourth and final year of the course. The course is specifically intended to educate students for a career as teachers of Technology Education in secondary schools

Two groups of students studying for the degree of B.Tech Ed were issued with questionnaires devised by Carol Dweck (1999). These questionnaires are designed to determine the implicit theories which people hold regarding the nature of intelligence. Two forms of the scale are available. One scale (the 'Self' scale) explores people's theories about their own intelligence, the other (The 'Others' scale) is used to predict the judgements which people make about intelligence in other people. In this case the 'Others' form of the scale was used. The respondents were also asked to give details regarding gender, age, ethnicity and the number of years spent out of the education system prior to entering the present course. There was also an open question which invited students to describe their understanding of the term 'intelligence.' Thirty three questionnaires were completed by students in the first year of the course and eleven were completed by students in fourth year. This represents 92% and 73% of the year groups respectively

Dweck (Dweck and Legget, 1998) postulates that two views of intelligence are held, which she labels entity and incremental. The entity view assumes that intelligence is a stable and global phenomenon. Incremental views on the other hand are based on the assumption that intelligence is malleable and can therefore change over time and according to context. The theories that are held by individuals have important implications in a number of ways which are important to teachers.

Qualitative and quantitative analysis of the questionnaires was carried out with open responses being analysed according to Sternberg's (1999) list of expert definitions of intelligence.

Although it is recognised that the small samples involved mean that any findings must be treated with caution, analysis of the two groups indicates some important differences in the views of intelligence held. These are

explored and the implications of the findings are discussed.

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**Title:** Is there a Core of D&T Knowledge?

**Author:** Tim Lewis, Sheffield Hallam University

In his paper 'A new paradigm for design and technology' Andy Breckon put forward **design and technological knowledge** as an element which should be assessed. He argued that acquiring this knowledge on a 'need to know basis' would not provide a sound basis for designing activities. This discussion about D&T knowledge and understanding has been on-going for several years, certainly it was under way prior to the introduction of the D&T national curriculum. It seems that this discussion prompts debate about the very nature of the subject. Does a pupil need a core of knowledge to enable them to design or can they acquire it as they work through designing activities?

As early as 1978 Mitcham attempted to describe technology as:

'four sequential steps; invention (research and development) – design – making (production and construction) – using (operation, sales, management)'

In this statement there is no mention of knowledge and understanding. He went on to say that these processes are characterised by:

'conceiving, (thinking in abstract terms), imaging (thinking in concrete or spatial terms, phantasmal thinking): fabrication (construction, thinking with the hands), and testing (operation and observation for discovery).

This statement fits comfortably with innovative design and technology activity but does not make reference to knowledge.

However, it seems that D&T has always stressed the importance of knowledge and understanding as part of the subject. This is confirmed in several papers and documents such as *'A' Level Design and Technology, The Identification of a Core Syllabus* (Threlfall 1985) which have appeared during the development of D&T. It seems that design and technology examinations at GCSE, AS and A2 levels have some form of written paper which seeks to test aspects of knowledge and understanding.

This research is based on an analysis of past and more recent design and technology examination syllabuses, specifications and examination papers to establish more precisely:

the nature of this knowledge and understanding;

the extent that this knowledge and understanding contributes to an understanding of, and ability to design;

how this knowledge and understanding relates to design and technology project activity, assessed through coursework;

the extent of commonality between different D&T examinations.

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**Title:** Beyond Pro/DESKTOP Computer Aided Design (CAD): the Transfer of CAD-based Design Modelling Skills from Schools to Higher Education.

**Authors:** Tony Hodgson and Clare Allsop, Department of Design and Technology, Loughborough University

Most schools in England and Wales now include the use of 3 Dimensional CAD modelling skills in their Design and Technology curriculum, and the great majority of those employ PTC Pro/DESKTOP as the software that is used to develop and implement 3D CAD modelling skills. The Industrial Design and Technology programme at Loughborough University includes an ICT intensive approach towards the rapid development of products in a commercial context, and so utilises a range of 3D CAD systems, together with other digital media, to develop, illustrate and simulate product design development. To this end, the programme tutors are keen to exploit any previous capability developed, particularly, during AS and A2 work in schools.

This paper reports on investigations into the ways in which Pro/DESKTOP software has been used in A2-Level work in schools, from the perception of 130 students embarking on their first year of the undergraduate Industrial Design and Technology programme. It suggests a range of uses, including simple demonstrations, short exercises and integrated use in the development of project-based course work. It continues by tracking and analysing the CAD modelling issues that arise as the same students develop capability with Pro/ENGINEER software. Whilst the software is similar in many respects, the greater range of features and options can make the new system difficult to learn, even for students with previous experience of CAD. The impact of previous work with Pro/DESKTOP is considered, by analysing the typical difficulties that are encountered during learning and by identifying those skills and capabilities that transfer from one system to another.

The research draws distinction between being able to use CAD modelling features and being able to model products in CAD. The need to move from Pro/DESKTOP to Pro/ENGINEER is clearly underpinned by the need to have sufficient capability with a sufficiently complex and appropriate CAD modelling system that the design intent is not compromised by use of the software. Such capability is not easily achieved and the greater understanding of transferable CAD skills will lead to more effective teaching and

learning of CAD modelling throughout the course programme.

A seamless progression from CAD work at A2-Level to that at Undergraduate Degree level is unlikely, in part because of the range of effective CAD capability across A-Level students and also because the different CAD software packages employ some differences in style and approach. As new releases of both Pro/DESKTOP and Pro/ENGINEER are implemented, and user interface and modelling philosophies converge, the paper considers some issues concerned with the transfer of generic CAD skills between School and University.

**Title:** 'It aint what you do it's the way that you do it'

**Authors:** Tony Lawler, Goldsmiths College and Martin Howlett, Tarporley Community High School, Cheshire.

We have taken a combination of current ideas on learning style and applied them to design and technology. The result is the identification of four designing styles. We have devised and conducted test activities, which allow us to identify dominant designing styles in Design and Technology pupils. The styles identified were wordist or picturist (the way the ideas are expressed), Big Pictures and Small Steps (the way the designing is progressed). These are styles that have been evolved and validated via the collaboration between Tarporley and Goldsmiths.

The pupils of Years 7 and 8 in Tarporley School have been tested and then regrouped into similar 'designing styles' and then the schemes of work and teaching styles modified to suit the particular group's preferred ways of working. Fundamental aspect of the work are:

the recognition that all pupils need all 4 aspects of designing style in order to become proficient;

that by 'starting where they are' will allow a faster and more comfortable transition towards more difficult (for them) aspects of the work.

This paper contains evidence of both the style identification activities and the results of the first two terms work in design and technology as compared with pupils and staff from a school where they have not had the benefit of this scheme.

The major findings in terms of the faculty staff are those of:

increased motivation and greater understanding of their own and their pupils capabilities;

a greater willingness to explore their own teaching and learning styles;

an awareness that all groups are getting better quicker but in different ways;

Within the pupils there are evidence of:

a greater level of harmony amongst pupil groups and therefore a high level of enthusiasm for the subject;

an ability to talk about their own strengths and weaknesses in a much more descriptive way;

the ability for pupils to talk not only about the project the subject, and the teacher but

to recognise aspects of their own leaning and the way their design and technology is managed. In short a greater degree of metacognition.

We believe that this is the start of a genuine understanding of design and technology education. As a result of this work we will be able to say more clearly what is unique about Design and Technology education, and we will know how to help pupils to develop those capabilities better, quicker.

**Title:** The Presentation of Systems Thinking in Support Materials for Secondary Design & Technology Pupils: A Review

**Author:** Torben Steeg, University of Manchester

Systems ideas as a tool for supporting pupils' thinking about a wide range of situations in Design and Technology (D&T) are now well established in UK curricula, syllabuses and texts. There is, however, circumstantial evidence from examinations, books and observation of work in lessons that the understandings of systems ideas held by many in education (including teachers, pupils, curriculum developers, book authors and examiners) are both diverse and, often, hazy. These various understandings of 'systems' have not been well documented.

As a precursor to an investigation of the understandings of systems ideas within the key player groups, the author (2000) described a typology of system diagram types in use in a broad range of systems literature. That paper used the typology to support a light scrutiny of a range of current design and technology texts aimed at secondary education in the UK. It concluded that the many difficulties experienced by teachers and pupils in using systems thinking to support work in design and technology (as required by the UK's National Curriculum for D&T) may be, at least in part, because systems thinking in school texts is often confused.

In this paper the analysis of systems diagrams in school texts, and other media used to support learning, is pursued at greater depth and breadth using an instrument that permits a detailed analysis of the approaches to teaching and supporting the development of systems thinking. This instrument is based on a development of the typology of systems theories and descriptive tools ideas described in the study above. A comprehensive sample of contemporary UK school textbooks and other learning resources supporting the teaching of secondary design and technology (i.e. in the age range 11-19) is subjected to this instrument. The purpose of this is to tease out both the implicit and explicit understandings of systems ideas that are presented to pupils and their teachers and the uses for systems thinking that are suggested, including their use to support pupils' understanding of technical and social systems, as a tool to help pupils describe such systems and as a tool to support pupils' own designing.

The paper details the findings of this analysis. It describes the influence that the literatures on systems theories have had on the

development and practical application of systems ideas in design and technology education and shows where important elements of these systems theories have become lost, misunderstood or compounded. The paper will also draw on a pilot study of pupils' understandings of systems ideas to illuminate its analysis.

In conclusion the analysis provides guidance for teachers, curriculum developers, authors and examiners on how the teaching and the acquisition of systems thinking can best be supported. This is particularly timely in the light of current concerns about the uptake of electronics and systems courses at GCSE and the DATA/Marconi ECT initiative to provide training for teachers in this area.

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**Title:** Valuing Progression in Design and Technology Education

**Author:** Mike Martin, Senior Lecturer,  
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This paper is a deliberately provocative exploration of some of the issues surrounding the challenge of: *meeting current demands for a highly skilled workforce whilst at the same time providing a broad and balanced experience for all young people in the UK*. It does this by exploring the skills of the future and the breadth of the curriculum. The paper proposes a way of bringing these two objectives together by focusing on depth of understanding as well as providing breadth of experience. It is argued that only by developing a depth of understanding of design processes by structured progression that design and technology education will make its unique contribution to pupils general education. The paper concludes that in order for this to be achieved, the design and technology community in the UK needs to focus on four key issues: outcomes; contexts; perspectives and pedagogy.

**Title:** Electronic Portfolios for Design and Technology. What if...?

**Author:** Andy Mitchell, Centre for D&T Education, Sheffield Hallam University

This paper concentrates on the work of students studying design and technology in Initial Teacher Education (ITE) at Sheffield Hallam University. As an early part of their course, they study a module that develops their ability to design and manufacture products using a range of skills and processes. This involves the origination, collation and presentation of a portfolio of evidence to support a number of physical product outcomes designed and manufactured during the semester.

Electronic portfolios are becoming common in the commercial world and in some areas of education. This project examines the potential enhancement of the teaching and learning opportunities brought about by the use of E-learning in ITE as an instrument for developing student's capability.

This small scale study attempts to evaluate the experiences of a group of 41 students in their first year of a two year route into teaching. They were required to submit for assessment an electronic record of their design work. This made use of commonly available software uploaded to their Blackboard E-learning 'site'. Students were deliberately provided with the minimum of support in the use of this technology to produce 'electronic portfolios' to incorporate qualities and aspects not previously associated with submissions made in printed format. Subsequently the project seeks to examine the contribution to the learning process of students completing this module. The methodology used by the researcher to collect data includes the use of observation, semi structured interviews, and a questionnaire.

**Title:** Gifted and Talented Pupils in Design and Technology at Key Stage Three

**Author:** Christine Arthington, Head of Food/Textiles, High Tunstall Comprehensive School, Hartlepool.

Awareness of the needs of Gifted and Talented [GAT] pupils has been raised in recent times through the introduction of Excellence in Cities [EiC] and other initiatives. However, there has been little work carried out in the Design and Technology [D&T] area. This research sets out to investigate the use of standardised tests in the form of the Middle Years Information System [MidYis] for identification of GAT pupils within D&T. It also looks at whether a more creative delivery can encourage even more imaginative ideas and improved satisfaction levels from these pupils.

MidYis data for a Year 7 cohort is examined and compared to the original system of using professional judgements, pupil self-nomination is also considered. Pupils were grouped according to MidYis ability for an initial group design task and questionnaires are used to determine their opinions on the project.

Results indicate that identification needs to be initially based on quantitative data although professional judgements must be employed to identify the pupil with a particular talent. It is concluded that self-nomination is not appropriate within D&T at this point but may be useful within whole school development work in the GAT area. Data should also be used in identification of underachievement.

Products produced by the test group, across all ability levels, showed more imagination in design than the control group. GAT pupils preferred to work with peers of similar ability for designing although when making they found 'passing on' their knowledge to less able pupils consolidated their own learning.