

DATA Annual International Research Conference 2004 - Paper abstracts

A Comparison of the Relationship Between Creativity, Learning Style Preference and Achievement at GCSE and Degree Level in the Context of Design and Technology Project Work
Stephanie Atkinson, Sunderland University, England

Abstract

This paper compared the relationship between creativity, achievement and learning style preference in the context of design and technology activity for two contrasting sets of learners. Data was collected from fifty-four students studying on an Initial Teacher Training Design and Technology degree and fifty pupils studying for their GCSE Design and Technology examination.

A creativity score for each sample member was established and individual achievement data was collected using marks from coursework projects at GCSE and degree level. Learning style data were collected from all participants using an established Cognitive Style Analysis test.

Results indicated that there were relatively few highly creative individuals, and that this was particularly noticeable in the student cohort, however the results did indicate the expected positive relationship between creativity and achievement for both cohorts. Similarities between the two samples in terms of learning style groupings were found. Analysis of the data also indicated that there was a clear relationship between level of achievement, being creative and certain learning styles, although for some learning style categories the results did not support existing research. Creative divergent thinkers did not achieve the expected results. This suggested the potential for a new study to see if the anomalies witnessed in these findings would be found in other pupil and student cohorts. There is also the need to research the relationship between the design process adopted and the way it is assessed to try to ascertain why certain creative pupils belonging to certain learning style categories are not reaching their potential.

Key words

creativity; learning style; achievement; design and technology project work; secondary education; tertiary education.

Girls' Decision Processes for Participation in Design and Technology Subjects in Zimbabwe's Secondary Schools
Chris Chimwayange and Janet Davies, Massey University, New Zealand

Abstract

This paper presents some preliminary findings from a multi-site case study of girls' decision-making in regard to participation in design and technology subjects in Zimbabwe. The attitudes and perceptions of fourth form girls, their design and technology teachers, school principal and parents are explored in one secondary school. Data were collected by questionnaire, focus group and interview and analysed through identification of recurring concepts in the data. Complex and interrelated factors influencing girls' decisions for subject participation were investigated through application of a model of achievement related choice (Eccles, 1994). This investigation supports the existence of eight factors, indicating most significantly that girls place value in subjects that provide the opportunity to fulfil their self-image or are consistent with their self-image. These findings contribute to understanding of girls' participation in design and technology in the African context, a dimension which is largely missing from mainstream debates on the subject.

Key words

secondary design and technology, design, gender, self image, culture, self-image.

Do We Have an Alternative Methodology for Teaching Design?

David Mioduser, Tel Aviv University and Osnat Dagan, Moshinsky Pedagogical Centre, Israel

Abstract

The study reported here is a research project aimed to examine the relationship between alternative approaches towards design teaching (structural or functional), and the students' mental modelling of the design process and the quality of their design process. The structural approach emphasizes the need for an ordered learning of the stages of the design process, while the functional approach emphasizes the teaching and study of design functions (rather than stages). 80 seventh graders, divided in two groups, were taught a unit on technological

problem solving by either approach for fourteen classes (21 hours). Before, during and after the design process of a technological solution the students had to generate representations of this process and make portfolios representing their problem solving process. The results were analysed looking for:

- The differences between the groups in the mental models which were constructed during the instruction process.
- The differences between the groups in the quality of the process and the design functions implemented.

Significant differences between the groups observed for many of the variables studied indicate that the functional approach represents a promising methodology for teaching design.

Key words:

design process, design functions, design teaching, mental models.

Exploring Creativity as a Component of the Manufacturing or Making Process: Implications for Assessment
John Dakers, University of Glasgow, Scotland

Abstract

Creativity is acknowledged to be an essential feature of design and technology (D&T). However, the current literature which explores aspects of creativity in D&T tends to portray the creative process as residing more in the design or problem-solving arena, as distinct from the action of manufacturing or making an end product. (Atkinson. 2002, Barlex. 2003, Davies T. 2002b, Davies L. 2002a, LTS. 2001, Rutland. 2002).

This paper will set out to explore whether aspects of creativity are actually present within the manufacturing or making domain. It will investigate whether the creative process is an action which can only occur in the process of manufacture or making, or if the creative process can be implicitly embedded within the actual finished product itself.

The paper will argue that there are two distinct forms of activity involved in the process of manufacture, which I will term "artistic craftsmanship" and "technical craftsmanship". The first type, it will be argued, involves a creative process whereas the second involves a skill process.

By exploring the distinction between "artistic craftsmanship" and "technical craftsmanship", moreover, the paper will explore whether creative endeavour can be recognised as an implicit value inherent within some end physical form. For example, does Michelangelo's "David", as an actual physical object, exhibit some inherent quality that in itself, demonstrates some form of creativity. Would a copy be considered creative?

The paper will finish by considering the implications for the assessment of an end product. If "artistic craftsmanship" is not inherent and embedded in the end product, the assessment of the finished product alone can take account of only "technical craftsmanship" displayed in the quality of the product. Creative aspects, it will be argued, are not displayed in the product alone, and cannot, therefore, be assessed in the product alone.

How do Trainee Primary Teachers Understand Creativity?
Dan Davies and Alan Howe, Bath Spa University College, Melanie Fasciato, Manchester Metropolitan University, Maggie Rogers, Goldsmiths' University of London, England

Abstract

This paper draws upon preliminary findings from research undertaken in three UK primary training providers as part of the Creative Teachers for Creative Learners project, funded by a Research and Development Award from the Teacher Training Agency. The project aims to support the development of primary trainee teachers' understanding of, and teaching for, children's creativity in design and technology (D&T) and other curriculum areas by producing an interactive bank of teaching and learning materials set within a Virtual Learning Environment (VLE). As an initial stage in the development of these materials, the project team has been exploring trainees' current understandings and perceptions of creativity, both as a personal attribute and as fostered by the primary curriculum in England. This paper will focus upon two sets of data generated as part of this process and the extent to which Harrington's (1990) "creative ecosystem" is a useful theoretical and evaluative framework for trainee teachers. At Bath Spa University College, primary PGCE trainees have been set a

directed task in schools during which they select lessons from two curriculum areas to observe: one which they expect to offer scope for creativity and another which they judge to lack creative potential. They have evaluated the support offered for children's creativity in each subject area using the framework drawn from Harrington (1990) and have frequently found their preconceptions challenged. At Manchester Metropolitan University and Goldsmiths' College, undergraduate trainees have produced cartoons to express their own notion of the "creative person". This has produced some interesting outcomes with regard to where opportunities for creativity can be found.

Key words:

creativity, teacher education, primary, curriculum, trainee's perceptions.

Out of the Box: the Promotion of Creativity in Learners

Ruth Dineen and Elspeth Collins, University of Wales Institute, Cardiff, Wales

Abstract

The DATA International Research Conference provides an opportunity for the "sharing of evidence across cultures". (Norman 2003: ix) This paper considers evidence from the culture of art and design higher education which, through its focus on creativity and individual development, could assist the achievement of design and technology's "unique contribution" to student learning. (QCA, 1999)

In presenting the case, this paper offers a new perspective on the "creativity in crisis" debate currently engaging design and technology educators. Similar contributions have been made by Martin (2003), Hopper & Downie (1998) and Shield (1995), amongst others. They highlight tensions within the sector, for example between "making" and "designing", between education and training, and between teacher-led and student-centred approaches, and suggest practical and philosophical ways in which such tensions could be alleviated.

The significance of the perspective offered here derives in part from the holistic nature of art and design education. It is suggested that this pedagogic model gains coherence through the placing of individual creativity at

its centre; curriculum structure, content, delivery and assessment are designed to support this focus. Findings from theoretical research (e.g. Perry 1968; Stein 1974; Amabile 1996) attest to the effectiveness of the approach, which is further confirmed by experiential research. The paper discusses these findings and suggests that a sharing of best-practice between the related disciplines of art, design and technology could help to lessen polarities and invigorate delivery of the design and technology curriculum.

Key words:

individual creativity, pedagogy.

The Role of Implicit Theories in the Development of Creative Classrooms *Wendy Dow, University of Glasgow, Scotland*

Abstract

Whilst there appears to be a consensus that creativity should be encouraged in the school curriculum in general and in the design and technology curriculum in particular, the extent to which this is a reality within the present day system is open to question. Whereas teachers appear to overwhelmingly endorse the desirability of developing creativity within the classroom (Feldhusen & Treffinger, 1975), there appear, paradoxically, to be factors either within individual teachers or within the system which in some instances militate against this.

This paper attempts to explain this problem through an exploration of the literature on creativity. It considers the implications of some of the issues arising from this literature for the successful development of creativity within the design and technology curriculum.

The paper examines the role of the teacher in providing structures within the classroom which may act as facilitators or barriers to creative practice in the design and technology classroom. The complex relationship between creativity and motivation, for example, is explored through some of the findings on the implications of external evaluation, concrete rewards and praise for creative work (Ames, 1992; Deci, 1971; Ryan & Deci, 2000; Amabile, 1986; Lepper & Greene, 1978), and the differing effects of competitive, collaborative and individualistic structures on the creative

process. (Johnstone & Johnstone, 1999; Nicholls, 1989). The importance of autonomy, diversity and risk-taking in fostering creativity is explored in relation to the work of Ames (1992) and Dweck (1999), and the extent to which teachers encourage the types of traits which appear to be part of the "creative personality" is considered in relation to studies such as those by Wallach and Kogan (1974) and Guilford (1959).

It is argued that the extent to which teachers are willing to adopt the type of structures and practices which will foster creativity in the design and technology classroom may be a function, not only of the education system but, perhaps more importantly, of the implicit theories which teachers hold in relation to creative ability in particular and to learning and assessment in general.

The role of Teacher Education Institutions is discussed as a means of addressing these issues.

The Evolution of Technicity: Whence Creativity and Innovation?

Mike Doyle, University of Leeds, England

Abstract

This paper introduces the concept of "technicity", a term borrowed from philosophy but recast in an Darwinian mould. Firstly, however, the presumption that language is THE unique and pre-eminent human trait is put to the adaptationist test. Evidence from palaeontology, primate studies and evolutionary psychology is brought together to (tentatively) suggest that language (speech) has a deep evolutionary past and that all members of the genus *Homo* possessed speech in some form. The second section marshals evidence that suggests our species possesses a new "making things" adaptation. This adaptation appears to be the basis for the speciation event that defines behaviourally modern humans: our species. This is the capability for which the term "technicity" is appropriated. The argument for splitting off language from technicity uses the concept of the extended phenotype. Technicity might best be characterised by a creative capacity to:

- a) deconstruct and reconstruct nature, and
- b) communicate by drawing.

The notion is floated that the newly evolved adaptation discretely insinuated itself into extant human culture; followed by brief consideration of the role of drawing, in the form of writing, on the precision and power of linguistic expression. It is suggested that technicity might usefully be considered the source of our intellect and language its whetstone. If further studies support the technicity hypothesis then reappraisal of conceptual framework underpinning the educational curriculum might be of benefit: a technology of language rather than the language of technology.

Key words

technicity, evolution, language, drawing, intellect, creativity.

Defining User Requirements and Strategies for a Multimedia Learning Environment Aimed at Enhancing Creativity in A' level Design and Technology Teaching and Learning.

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Abstract

This paper describes preliminary research into establishing strategies for designing computer-based learning material, which have the potential to enhance creativity in post-16 design and technology (D&T) A' level students. It explores meanings and perceptions of creativity from the point of view of D&T students.

A series of three focus group interviews were carried out with A' level students, in which aspects of creativity within the D&T classroom were discussed. The interviews provide insights into what students need from learning expressed in their own words. These insights are envisaged to provide an empirical basis for the future design and implementation of an interactive multimedia learning environment (IMLE), aimed at enhancing students' creativity.

The design and implementation of the learning environment will take place in the further stages of the wider research project, which identifying user requirements is a part of. The findings of the interviews form a list of user requirements to be used within an IMLE, concerning aspects of pedagogy and curriculum, or in terms of computer based

learning, recommendations on the structuring of content and the structuring of learning interactions. Among the key findings are the need for, and importance of, collaborative work, discussing ideas and sharing perspectives, to developing and encouraging generative as well as evaluative thinking in students.

The computer as a dialogue partner emerges as a valuable conceptual model within human computer interactions. The constructivist paradigm is seen as appropriate in supporting students' natural learning strategy, experiential learning and the type of task-oriented, problem solving learning environment which would best support creative thinking in D&T.

The findings discussed in this paper form the first part of a wider PhD research which explores the potential of multimedia technology and structured learning to enhancing creativity in D&T A' level students. The stages of design and implementation of the learning environment are the next step of the research which will build directly on the findings of interview data discussed in this paper.

Key words

multimedia learning, D&T, creativity, learning environment design, pedagogy, constructivism.

Compliance and Creativity? Compliance or Creativity?

Debbie Haffenden, University of Brighton,

Abstract

Many teachers and pupils today are beginning to question current primary educational practice (Ogunleye, 2003, Wragg, 2003). They find themselves compliant to an overcrowded curriculum model based on content rather than pedagogy. Those who recognise that engagement and enjoyment is key to learning complain of frustration with a lack of opportunity to address teaching and learning more creatively (MacGilchrist, 2003, Hofkins, 2003). For those committed to broadening educational opportunities for all children so they can participate in the twenty-first century, is it not time to reconsider the current curriculum model that appears to be failing so many?

This paper reports on selected results of case study collaborative action research in the

primary curriculum. It focuses on the implementation, in a class of Year Six pupils, of a cross-curricula project-based model where design and technology provided the integrative focus. This model sought to overcome a pedagogical dichotomy between compliance and creativity, raised by the Headteacher and recognised in the literature. The research addressed two important questions:

- Was it feasible, in a climate under immense pressure to focus on standards and measurement in the core subjects, to provide a broad and balanced primary curriculum model which embraced rather than marginalised the arts?
- Would such an alternative model allow teachers to explore more creative learning and teaching methods and encourage greater levels of engagement on behalf of the pupils?

The paper highlights the wider context surrounding the current primary curriculum debate and presents selected findings which provided evidence to suggest that through the application of a process-led pedagogy it is possible to address compliance with National Strategies and the National Curriculum whilst at the same time enhance the creative potential of learning and teaching.

Key words:

compliance, creativity, design and technology, primary curriculum, project-based model.

Enhancing Learning Through Dialogue and Reasoning Within Collaborative Problem Solving.

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Abstract

A co-constructivist view of learning places a significant emphasis on classroom interaction and social learning. "Students prefer an active to a passive role; they prefer transaction to transmission; and they want to learn through a range of activities" (Morgan and Morris, 1999). Technology and design has the potential to provide opportunities for students to be active in their learning: to discuss, to think, to plan, to make decisions, to reflect and apply. Consequently, teachers need to provide classroom learning environments that will promote learner empowerment through collaboration, interdependence and problem solving dialogue.

The present study focuses on the use of dialogue as a tool for thinking and reasoning within collaborative problem solving. Two groups of students were involved: a PGCE group of student teachers (Case Study 1) and a group of eleven-year-old primary school pupils (Case Study 2). Each group was operating within the context of a normal classroom setting. Stories were used to provide a context or "natural setting" for practical problem solving. In both case studies the role of the tutor was to encourage learner centred dialogue, experimentation and active engagement with the problem(s).

PGCE students were asked to complete two questionnaires, one prior to the activity and one upon completion. Primary school children completed only one evaluative questionnaire at the end of their activity. Video and audio recordings of both groups were used to provide transcripts that enabled a more detailed conversation analysis to be undertaken. This analysis showed the importance of interaction in learning and the kind of talk and collaboration that is needed to facilitate such learning. The extent to which the PGCE student teachers were able to identify and use the range of higher order thinking skills embedded within technology and design, problem solving activity was also investigated.

Analysis of the data revealed significant changes in PGCE student perceptions of the contribution of technology and design to the development of children's thinking. The post-task questionnaire indicated heightened awareness of the qualitative nature of the task, especially the value of collaborative learning and dialogue within problem solving. The primary school pupils identified fully with the story context, and it was this that fuelled their high levels of interaction and collaboration. Through a careful use of language, at critical incidents in the problem solving process, the teacher was able to scaffold pupil learning and provide the kind of assistance that enabled the pupils to achieve at much higher levels than they would have done unaided. The importance of learning through active engagement, using a problem solving dialogue, was highlighted in both case studies.

Key words

co-constructivist, interaction, learner empowerment, dialogue, collaboration, active engagement.

Questioning Styles: Observations of Differences in Practice at Key Stage 2 and Key Stage 3

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Abstract

This small-scale school-based research funded through the Best Practice Research Scholarship (BPRS) considers the different questioning styles used by teachers at Key Stage 2 (KS2) and Key Stage 3 (KS3). This research topic was selected because of perceived differences in the creativity seen in children's work at the beginning and end of Key Stage 3. A literature search indicated that the use of open-ended questions was a recognised strategy that could be used by teachers to promote creativity in children. The research strategy adopted therefore set out to establish the possible nature of any differences in the classroom questioning strategies adopted by Key Stage 2 teachers and Key Stage 3 teachers and also to observe any other apparent differences in the teaching and learning approaches. The research evidence established that Key Stage 3 teachers do use more closed questions and suggests the need for detailed research concerning the impact this might have on pupils' project outcomes. A discussion of the possible links between questioning techniques and the creativity of the pupils' projects is included.

Key words

open questions, closed questions, teaching strategies, Key Stage 2, Key Stage 3, creativity.

'Little c' Creativity and 'Big I' Innovation Within the Context of Design and Technology Education

Gill Hope, Canterbury Christ Church University College, England

Introduction

The title of this paper is based on Craft's (2001) distinction between everyday "little c" creativity and the "big C" creativity of Picasso or Einstein. Craft's "little c" creativity is close to Boden's (1994) P(ersonal)-creativity, and, perhaps, is even related to Kuhn's (1962) "normal science." Boden's H(istoric)-creativity is more likely to be associated with the occurrence of Kuhn's "paradigm shift" which, for the purposes of this paper, is called "Big I" innovation.

As a generalization, creativity research splits in to two forms: process research and product research. Isaak & Just (1996) claim that the traditional emphasis on generative processes and consequent neglect of analytical process has led to a confusion between insight and invention. Mumford et al. (1994:3) wisely begin with the words "creativity is reflected in" rather than "creativity is":

Creativity is reflected in the generation of novel, socially valued products.

There are multiple views on what creativity is, with definitions proffered from such standpoints of psychodynamics, humanism, cognitivism, social constructivism and more. Away from the debate of an inner quality, ethereal (perhaps ephemeral?), designing technology equates to producing something tangible, viewable, open to comment and appraisal. Design and technology (D&T) educators are interested in the process (how can we foster it?) but also look to the product: what will they produce (by end of the course).

D&T Making a Difference in Black Ethnic Minority Education: the Sheffield LEA ICSYS Partnership

Tim Lewis, John Lee, Prakash Ross, Jenny Dein and John Dawson, Sheffield Hallam University/Sheffield LEA, England

Abstract

An innovative interpretation of the Inequality Challenge for South Yorkshire Schools (ICSYS) project by Sheffield LEA has resulted in a partnership between the LEA, local schools and Sheffield Hallam University (SHU). The aim of the project is to provide black ethnic minority (BEM) pupils with a high quality design and technology (D&T) experience, which promotes career opportunities in the field of contemporary manufacturing and engineering. To achieve this aim computer aided design and manufacturing (CAD/CAM), acknowledged as a highly motivating aspect of the modern D&T curriculum, has been selected as the vehicle for the teaching and learning experiences that the pupils will be exposed to. The project is funded by Objective 1 European Social Funding via the Learning and Skills Council.

To achieve the aim the project incorporated the following elements:

- DATA accredited CAD/CAM INSET in SpeedStep and ArtCAM for teachers in participating schools.
- A programme of pupil visits to manufacturing industry where the focus was on applications of CAD/CAM processes in "high tech" industry.
- CAD/CAM workshops for pupils in the university where they participated in small group activities led by D&T initial teacher education (ITE) students.
- The development of innovative CAD/CAM projects with the aim of encouraging BEM pupils to consider careers in "high tech" manufacturing.
- Opportunities for BEM pupils to gain experience of "university life".
- Follow up CAD/CAM teaching in schools by university staff.
- Opportunities for pupils to develop their presentation skills.

Initial research drawn from industrial sources highlighted the need for increasing the supply of engineers, particularly in South Yorkshire, and called for further educational initiatives. Research of national data confirmed the LEA's view that engineering and manufacturing were not strong career aspirations for BEM pupils. Further research with BEM pupils confirmed this. During the ICSYS experience pupils' views of manufacturing, particularly the "high tech." aspect represented by CAD/CAM were monitored by questionnaires. Triangulation of the research was by an independent evaluation using semi-structured interview techniques. The paper concludes with details of the extent to which pupils attitudes can be changed by this type of positive intervention. Additionally, it details those areas of the project which have been particularly successful so providing helpful information to both present and future D&T teachers whose groups include BEM pupils.

Key words:

black ethnic minority, BEM, CAD/CAM, ICSYS, D&T, design and technology, inclusion, positive intervention, manufacturing.

Design and Technology (D&T) and Citizenship: Changing Attitudes?

Colin Chapman, Tim Lewis and Kirsty Smart, Sheffield Hallam University, England

Abstract

By linking the Design Against Crime (DAC) Education initiative, funded by the Home Office and the Design Council, to the emerging Citizenship curriculum in schools it has been possible to provide D&T teachers with the opportunities to make their contribution to this new cross-curricular subject. The DAC education hypothesis is that understanding of, and attitudes to, crime issues can be modified if pupils are presented with a D&T project which has study of crime, and a focus on crime issues, embedded in it. The research, conducted during 2003, was to establish the extent to which this hypothesis can be proved.

Two schools were involved in the project, one a large comprehensive school serving a mainly rural community, the second an urban comprehensive school with a varied catchment area. The research involved in excess of 100 pupils. Year 8 pupils in each school were divided into research and control groups. The initial research involved both groups in each school engaging in focus group activities to establish a bench mark about their attitudes to crime issues. The research groups did a DAC D&T project while the control groups worked through the school's usual D&T scheme of work. Further focus group activities were used to establish the effects, if any, in pupils' understanding and attitudes to crime. Teachers were also consulted about their experiences of managing DAC projects within D&T. The paper describes focus group work with pupils which included several innovative features, for example set tasks used to promote discussion and establish decision making.

The paper concludes with a discussion about the encouraging results which demonstrate that the DAC projects did bring about a change. One aspect was a change in pupils' ability to be discriminating when making complex judgements. Additionally, the interviews revealed fascinating information about pupils' attitudes to social issues

Key words: citizenship, designing, design and technology, crime, pupil attitudes, teachers perceptions, Design Against Crime, DAC.

Forensics and Autopsies: Exploiting Popular Culture to Teach Design for Commercial Manufacture?

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Abstract

Forensic science is the discipline that students and parents consider as most interesting, providing a well paid and satisfying career (Manufacturing Foundation 2003). The influence of popular culture and the high level of media exposure may be a reason for this positive perception. Contrary to this, there seems to be a negative image of manufacturing, often perpetuated by the media. This anti-manufacturing attitude has prevailed for some time and is acknowledged by many (e.g. Scottish Executive, Make It Scotland, RSA, Foresight, MORI/EMTA, Unipart, The Manufacturing Institute). Industry and universities alike are finding it increasingly difficult to find enthusiastic recruits.

This paper reviews current approaches to teaching the relatively new curriculum content (SQA, 1999) of commercial manufacture in the Scottish secondary school system and describes development work with in-service teachers and school students. The development work described aims to challenge the anti-manufacturing stereotype through a pedagogy designed on motivational principles and explicit use of the language and tools of popular media culture. The approach taken exploits the interest in all things "forensic" and uses "product autopsy". It aims to link the author's previous work in exploring values and expressing opinions in Technology Education (McLaren, 1997) with recent curriculum developments and related teaching strategies. The integrated approach attempts to encourage greater engagement in aspects of technological sensitivity and technological perspective (SCCC, 1996) when learning about designing for commercial manufacture.

Key words

forensics; autopsy; commercial manufacture; motivation; popular culture; curriculum development.

Approaches to Teaching Pupils with Behavioural, Emotional and Social Difficulties in Design and Technology.

Louise Davies QCA and James Fox, Peter Grover and Andy Mitchell Sheffield Hallam University, England

Abstract

The DfES defines pupils with Behavioural, Emotional and Social Difficulties (BESDs) as people who are:

Withdrawn or isolated, disruptive and disturbing, hyperactive and lack concentration; those with immature social skills; and those presenting challenging behaviours arising from other complex special needs.
(DfES 2001: 58).

This definition encompasses a very broad range of children with diverse needs. However, there are common approaches that can be used to meet the needs of these children in design and technology (D&T). Traditionally design and technology has been a particularly popular subject for pupils displaying BESDs. There has been little research as to why this should be. This paper explores practice in D&T by making reference to case study material collected from four schools. The case studies were commissioned by the Qualifications and Curriculum Authority (QCA) for dissemination via the NCAction website (a searchable resource for schools that illustrates how the National Curriculum works in practice). The case studies considered activity undertaken by pupils working in resistant materials, food technology and CAD/CAM. The case studies highlighted the use, by teachers of pupils with BESDs, of common approaches including group work, raising self esteem, the use of rewards and challenge, relevance and using ICT.

Key words

behavioural, emotional and social difficulties (BESDs), group work, self esteem, rewards, special schools.

Teaching and Learning Creativity

Bill Nicholl, University of Cambridge, England

Abstract

Creativity is not an easy phenomenon to define and hence understand. Perhaps this is partly the reason why there seems to be "issues" in creativity and design and technology education. Some approaches to understanding creativity have focused on one area, for example the cognitive approach. There are however, a number of researchers who suggest that there are many inter-related factors that seem to contribute towards understanding creativity. These have become known as multidisciplinary approaches.

This paper outlines one such approach to creativity, Csickszentmihalyi's "Systems Perspective" for studying creativity. A number of implications and issues will be explored with respect to the teaching and learning of creativity in design and technology (D&T). The teacher it is argued, has a significant role in increasing the likelihood of creativity in the D&T classroom.

This paper is limited to a small case study, but seeks to generate a debate in order to help demystify the phenomenon of creativity, how it may inform practice in the D&T classroom, and ultimately increase the likelihood of creativity for pupils studying D&T.

Key words

creativity, design and technology, motivation, pedagogy, socio-cultural.

Creativity: is it on the Key Stage 3 (11 -14 years) Design and Technology (D&T) Agenda?
Marion Rutland, University of Surrey
Roehampton, England

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".

Creativity in Design and Technology and ICT: Imagining Possibilities in a Digital Age.

David Spendlove, University of Manchester and Matthew Hopper, Liverpool John Moores University, England

Abstract

The issues raised in this paper relate both to the current climate in education and the changing demands within two relatively "young" curriculum subjects: design and technology (D&T) and information communication technology (ICT, previously information technology, IT). Both subjects have ultimately evolved from the same subject as outlined in the first National Curriculum Order for Technology (DES/WO 1990) and continue to share similarities as identified in the National Curriculum for England 2000 statement of importance, as both subjects aim to prepare pupils for participation in a rapidly changing world using new technologies.

This paper will highlight how the rapid development of both D&T and ICT has been accompanied, and to some extent driven, by the emphasis which has been placed in recent times upon the increased use of ICT as part of the drive to raise standards in schools. The central tenet of this work is that whilst recognising the value of ICT, this imposed imperative and its

impact upon both the content of D&T teaching programmes and the methods adopted for their delivery may have compromised the principal aims of the subject as exemplified in the National Curriculum statement of importance and also constrained the potential for the development of learners' creativity and imagination in D&T. The work goes on to make a case for a shift in emphasis and the adoption of ICT as a tool within a creative continuum rather than as the principal focus for learning.

By considering the role of ICT, and in particular ICT rich activities such as CAD/CAM and ECT initiatives within D&T, the paper will consider how constrained practice in both subjects has marginalized D&T capability and creative practice. This propositional paper will further argue that by redefining pedagogical models for D&T and the use of ICT within the subject, both activities have the potential to promote rather than to constrain creative practice and so offer the potential of enhanced levels of design and technology capability for all learners.

Key words

design and technology, creativity, ICT, capability, models, pedagogical.

Emerging Technologies - Some Strategies for a Future of Design and the Formation of Somatic Experience.

Stephen Thompson, University of Wales, Newport, Wales

Abstract

This brief paper highlights some of the issues that have arisen in a research that emerging from the experience of attempting to extend design analysis and criticism into those student projects which engaged with "incorporated technologies" such as nanotechnology, virtual and augmented reality, DNA computing or implant augmentation. The research itself will take the form of a number of narratives intended to explore and invite discussion of ideas drawn from philosophy and science, posited as a means to initiate discussion among designers. This paper particularly explores how this process of dialogue arose from the discussion of complex and "uncertain" ideas with student designers and emerged from the experience of developing curricula for the undergraduate "design futures" course at the University of Wales. It is

suggested that issues emerging from this research may have some impact upon the design of future pedagogies for design education and upon the future of industrial design conceptualisation. Questions are raised of the methodology of those designers who claim to model users experiences through metaphoric or comparative allusion to antique models of mechanical processes or through social interactions conceived to bear comparison with established human rituals. The paper describes how a speculative method of dialogue is being designed in order to explore the potential of an extensionist philosophical model. The dialogic method, whilst still in the process of construction, is centred upon a process of "story-telling". It is anticipated that these stories will go some way towards the embodied, inclusion of emerging uncertain and unorthodox ideas of "extension" in philosophy, biology, ecology, psychology and neuroscientific into the schema of industrial design conceptualisation.

Key words

Industrial Design, emerging technology, interaction, ontology, scenario filmmaking

Innovative Design and Technology Education in a Virtual Learning Environment.

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Abstract

The Iceland University of Education is currently directing the three-year European Union project InnoEd, which is sponsored by the Minerva Project. InnoEd is a cooperative venture of four countries in the area of Innovation Education: Iceland, Finland, England and Norway. In this project the course in Innovation Education is set up on the Internet (www.innoed.is) and the students work online with their ideas in real time instead of an earlier classroom based model. In addition, the participants have developed a specialised data driven website used for communication and teaching as well as storage and research for all participants. Here the envelope of Information Technology will be pushed to new extremes in the area of Innovation Education.

Key words

Innovation Education, design and technology,

Information and Computer Technology, research, InnoEd, National Curriculum, Virtual learning environment, Creativity, practical use of knowledge, Internet, inventions, design.

Portfolios in Design and Technology Education: Investigating Differing Views *Malcolm Welch, Queens University, Canada and Dr David Barlex, Nuffield Foundation, England*

Abstract

In many professions, portfolios constitute a primary method of documenting proficiency, skill, style and talent by showing examples of actual work. However, the multiple purposes of portfolios in design and technology education have given rise to problems. The conversion of a portfolio into a product has become a significant problem, as have the constraints imposed by examining bodies.

This paper will describe a research study that investigated the use of portfolios in professional practice, initial teacher education and secondary design and technology education. Separate focus group interviews were conducted with professional designers, teacher educators and secondary school teachers of design and technology education in both England and Canada. Questions asked of participants focused on definitions and the advantages and disadvantages of using a portfolio, as well as the particular purposes of portfolios in the context of the professional work of each group. Audiotapes of the interviews were transcribed verbatim. Analysis of the data involved thematic analysis and concept analysis.

Preliminary analysis of the data has identified that professionals use four types of folio, each for a quite different purpose. These findings have given rise to questions about how these four types of folio could be used to enhance teaching, learning and assessment in design and technology education, and to what extent the adoption of these four types of folio could resolve the conflict between the portfolio as a teaching and learning tool and the portfolio as an assessment instrument.

Key words: design and technology (D&T) education, authentic assessment, portfolios, constructivist learning.