

The European Journal of Social & Behavioural Sciences (eISSN: 2301-2218)

## Reviewing the Impact of the National Strategies Design and Technology Framework for Key Stage Three

Matt McLain<sup>a\*</sup>, Dawne Bell<sup>b</sup>, Justine Smith<sup>b</sup>, Mike Martin<sup>a</sup>

<sup>a</sup>Liverpool John Moores University, IM Marsh Campus, Liverpool, L17 6BD, UK

<sup>b</sup>Edge Hill University, Ormskirk, Lancashire, L39 4QP, UK

<http://dx.doi.org/10.15405/ejsbs.119>

### Abstract

Since the beginning of Design and Technology (D&T) in the English secondary school curriculum, the teaching of design has been identified as less effective than that of making. In 2004 as part of the National Strategies, the D&T framework was launched, aiming to support the teaching of design skills. This small-scale study begins to explore the experiences of pupils and teachers in four schools in the Northwest of England. The study uses a mixed methods approach, gathering quantitative and qualitative data in a questionnaire with a convenience sample of school pupils. Responses are analysed alongside qualitative interviews with D&T teachers from the schools. The findings indicate that many pupils had a clear understanding of the role and function of designing. However, some common assumptions of the nature of design activity centering on the act of sketching or drawing were evident. Whilst some progress has been made in the teaching of design, through the use of design activities introduced in the D&T Framework, the support experienced by teachers was limited and were not sustained beyond the initial training. There are implications for initial teacher educators in supporting beginning teachers and balancing the tensions trainees experience whilst on placements in school.

© 2014 Published by C-crcs. Peer-review under responsibility of Editor or Guest Editor of the EJSBS.

**Keywords:** Design; designing; pedagogy; teacher education design and technology; D&T.

\* Corresponding author. Tel.: +44-151-231-4622

E-mail address: m.n.mclain@ljmu.ac.uk



## 1. Introduction

In 2004 the National Strategies programme in English schools introduced the Design and Technology (D&T) Framework, as part of the Key Stage 3 Strategy (DfES, 2004). The D&T Framework was introduced in response to Ofsted school inspection findings over a period of about four years or more, which identified the teaching of designing to be problematic. Since the introduction of D&T as a National Curriculum subject in 1995 the teaching of design has been one of concern, both from within (Kimbell et al, 1991) and outside (Ofsted, 2002a) the D&T education community; with the subject having evolved from its roots in craft education, where the focus was on making (Morley, 2002: 3-12; Fasciato, 2002: 27-42). This transition from a crafts based curriculum where design was either not central or at best emergent, has been a challenge for both curriculum leaders in schools (at all levels) and the classroom teacher (McLain, 2012; Martin and Riggs, 1999). The rationale for this study was to begin to evaluate the impact the D&T Framework training has had on the teaching of D&T at Key Stage 3 (KS3) in the eight years since the launch of the D&T Framework. The research focus is on the impact of the strategies and activities from the framework to support the teaching of design. The data, for this preliminary study, was gathered in five schools in the Greater Merseyside area in the North West of England.

## 2. Literature Review

During the subject's short history in England, the nature and pedagogy of design (in D&T education) has been a challenge. In the early years of National Curriculum in England the Assessment and Performance Unit (APU) reported on the assessment of designing and making (Kimbell et al, 1991). As a direct result of the Parkes Report (DES/WO, 1988) within the subsequent introduction of the 1988 Education reform Act, individual subject disciplines; Craft, Design and Technology and Home Economics were brought together under the single banner of Technology (NCC, 1990). The report envisaged a subject where learners had a "balanced experience of the use of different resources of knowledge and skills" (pp.8). As a result of the Education Reform Act (1988), the then Secretary of State for Education, Sir Kenneth Baker defined design and technology as a subject:

*"...in which pupils design and make useful objects or systems, thus developing their ability to solve practical problems"* (DES/WO 1988: 68)

Baker was clear in his remit, defining a context for how this new subject would operate and highlighting the preferred curriculum allegiances:

*"The working group should assume that pupils will draw on knowledge and skills from a range of subject areas, but always involving science or mathematics"* (DES/WO 1988: 86-7)

This bias towards the application of science and mathematics may have been a factor contributing to the displacement of designing and design learning within the early years. Alongside this (and in possibly tension with) the APU report described a number of new and alternative approaches to design and technological activity, including the introduction of extended coursework at GCSE and 90 minute tests (Kimbell et al, 1991: 35-40). The extended coursework innovation at Key Stage 4 has remained, but the 90 minute tests, focused on designing, have not become embedded in the wider D&T praxis in the subsequent years.

*"Overall, teaching is good in two-thirds of schools, but there are significant areas of weakness including, in Key Stage 3, the teaching of designing and of systems and control."* (Ofsted, 2002a: 3)

*"[Key Stage 3 pupils'] progress in making continues to be better than their designing, an intractable problem reported over many years..."* (Ofsted, 2002a: 4)

Ofsted subject reports for D&T identified endemic problems in the teaching of design, although this was not the case with the teaching of making skills. The “superfluous decoration” of design folders over the development of design ideas was stereotyped as typical practice in KS3. In the same year Ofsted acknowledged that the teaching of design was complex and demanding (Ofsted, 2002b: 4). An additional factor cited by Ofsted was the impact of the design and make activity, which when could lead to an overemphasis on a narrow range of skills and thus limiting opportunity to develop and “extend the generic skills of designing” (Ofsted, 2001: 4).

In 2004 as part of the National Strategies initiative the Key Stage 3 Strategy D&T Framework was introduced to address these shortcomings (DfES, 2004), following a pilot in 10 local authorities in 2003-4 (Ofsted, 2008: 48). The aim of the framework was to address the shortcomings in the teaching of design, by emphasising the planning for the inclusion of five sub skills of design and adding a range of design activities to support and develop D&T pedagogy. Whilst “making high-quality products” (p.14) was acknowledged as important, the focus of the initiative was on developing the sub skills of:

- Exploring ideas and the task;
- Generating ideas;
- Developing and modelling ideas;
- Planning;
- Evaluating;

The framework reinforced the notion of the design process being non-linear (Kimbell et al, 1991; DfES, 2004), an issue raised by many in the D&T community (Kimbell et al, 1991; Atkinson, 2002; Morley, 2004; Rutland and Spendlove, 2007; McLain, 2012), encouraging a focus on “autonomy, creativity, reflection and group work” (DfES, 2004: 18). However, the national roll out of training was considered to be “weak” (Ofsted, 2008: 48) resulting in “continuing fragmentation of the curriculum in Key Stage 3” in many schools.

*“In too many of the schools visited, teachers’ interpretation of the assessment requirements meant that pupils were pushed through a series of hoops, corresponding to stages in designing, to secure marks for their coursework portfolios. This rewards the conformist rather than the risk-taking innovator. It stifles creativity and encourages formulaic thinking and the embellishment of design drawing rather than rigorous thinking about designing.” (Ofsted, 2008: 49)*

It is within this context that this study is framed. Through this research we would seek to recognise the value in the strategies collected in the D&T Framework of 2004, but critique the ‘uneven’ experience of both pupils and their teachers.

### **3. Research Methodology and Methods**

The methodological approach adopted for this study is principally quantitative in terms of the initial data gathered. However, the ontological and epistemological assumptions tend toward an interpretive approach (Lincoln, Lynham and Guba, 2011: 98-116), where secondary, qualitative, data being gathered recognises the multiple realities and understanding of the participants in regard to their engagement with learning and the world around them (Guba, 1981: 77) some may argue however that the overarching methodology employed is that of Mixed Methods (Creswell, 2011).

Specifically the research consisted of an initial questionnaire, which was designed to elicit responses from pupils in Year 8 (12 to 13 years old) and Year 9 (13 to 14 years old), about their experience and awareness of design learning. The decision to exclude pupils at the beginning of KS3 was to focus in their experience within the secondary school

environment, as the survey was deployed at the beginning of the first term in the 2012/2013 academic year. Key Stage 3 (KS3) is the early Secondary Education phase within English schools, where pupils at the age of 11 move from Primary School. The design of the survey, following guidance by Cohen, Manion and Morrison (2005) and Aldridge and Levine (2001), the questionnaire was kept to nine short questions, employing a combination of both open and closed questions. The questionnaire was trialed in the Summer term in 2012, with a group of pupils not included in this study, prior to the deployment in Autumn 2012.

The sampling method used for selecting participants was on a convenience basis (Cohen, Manion and Morrison, 2005: 102). As a non-probability sample of the population of Key Stage 3 pupils, even within the Greater Merseyside region (as the region where the research team are based), it does not purport to represent the body of pupils. Rather, it seeks to identify a snapshot of D&T practice within the educational setting, where staff and Initial Teacher Education (ITE) trainees from a Merseyside Higher Education Institution (HEI) were involve, during the period between September and December 2012.

#### 4. Research Findings

##### *Question 1: "What is the name of your school?"*

The survey was undertaken in five secondary schools in the Greater Merseyside area with 202 pupils. Table 1 shows the breakdown of participants.

**Table 1** (n = 202)

School	No. of pupils	School profile	Specialism	Age Range	NOR*
S1	13	Girls Roman Catholic (Liverpool)	Technology	11-18	1297
S2	60	Mixed Comprehensive (Liverpool)	Engineering	11-18	835
S3	51	Mixed Comprehensive (St Helens)	Sports	11-16	600
S4	38	Mixed Comprehensive (St Helens)	Technology	11-18	1421
S5	40	Mixed Comprehensive (Liverpool)	Business & Enterprise	11-18	792

\* Number on role taken from the [www.ofsed.gov.uk](http://www.ofsed.gov.uk)

##### *Question 2: "What gender are you?"* and

##### *Question 3: "Which of the options below describes you?"*

Table 2 shows the breakdown of male and female participants by age category.

**Table 2** (n = 202)

Number of schools	Male	Female	Total
Number of Year 8 pupils	49	62	111
Number of Year 9 pupils	55	32	87
Undisclosed Year Group	0	4	4
<b>Total</b>	<b>104</b>	<b>98</b>	<b>202</b>

**Question 4:** “Which Design and Technology (D&T) areas have you experienced in KS3?”

Year 7 pupils were not included in this survey, as they would not have experienced the range of D&T areas at the time that the questionnaire was being completed. This question was asked to identify any correlation between the range of D&T areas and the perceived experience of design. The underlying hypothesis behind this question is that in curricular arrangements where the full range of D&T areas are taught there may be a perception that there is limited time to develop design skills or that there is a greater value placed on making skills and activity. The data showed that pupils have experience of and access to Electronics (excluding school S5), Food, Resistant Materials and Textiles. The responses to ‘other’ included Graphics, Engineering, Computer Aided Design (CAD) and Enterprise as areas experience within KS3 D&T curriculum. Pupils from all schools identified Graphics as a discrete area, with S2 being the only to identify Engineering \*(note that S2 have a specialism as an Engineering College), S3 CAD and S4 Enterprise.

**Question 5:** “Which ONE of the following statements do you most agree with? When I am designing in D&T, I...”

In order to gauge pupils’ perceptions of design and design activity, they were asked to choose a statement that best described what they believed they were doing when undertaking tasks referred to as designing. The options were based on common misconceptions expressed by trainees on the one-year Postgraduate Certificate in Education (PGCE) D&T initial teacher education programme between 2009 and 2012, at one of the participating HEIs, and dictionary definitions. The options relating to drawing as design activity we placed at the bottom of the list to avoid pupils automatically opting for the most familiar preconception of design activity. Table 3 (below) shows the pupils response, indicating the most to least frequent responses.

**Table 3** “When I am designing in D&T, I...” (n = 180)

Design activity	No. of pupils	Percentage	Rank order
...am creative	77	43.00%	1
...use my imagination	43	24.00%	2
...solve problems	3	1.700%	7
...combine different shapes, components or ingredients	10	5.600%	5
...draw what I think my product will look like	24	13.400%	3
...draw similar ideas to other pupils in my class	6	3.400%	6
...come up with more than one idea	17	9.500%	4
No response (discounted)	5	N/A	N/A
Multiple responses (discounted)	17	N/A	N/A

Note that five pupils did not identify a response and 17 gave multiple – these responses have been discounted (n = 180) as the survey was seeking a single, best-fit, response.

**Question 6:** “Have you been shown how to design and come up with ideas?”

This question sought to gauge whether pupils were aware of whether they had be taught how to design. Table 4 shows the responses to this question. Note that five pupils did not identify a response and one chose ‘Yes’ and ‘Don’t know’ – these responses have been discounted, hence n = 196

**Table 4:** Pupils awareness of being taught how to design (n = 196)

Responses	No. of pupils	Percentage
Yes	171	87.200%
No	6	3.100%
Don't know	19	9.700%
No response (discounted)	5	N/A
Multiple responses (discounted)	1	N/A

**Question 7:** “Which of the following activities have you experienced in D&T lessons”

The D&T Framework introduced a wide range of design activities within the five sub skills of design. These were drawn together from a range of sources in the National Strategies materials. The options presented in the questionnaire represent a sample of activities from the Framework, with a number of general activities that might be associated with designing (e.g. sketching and isometric drawing). These were presented in a random order. Table 5 shows the responses with percentages and in rank order. For this question, pupils were free to choose multiple responses.

**Table 5:** D&T Framework design activities experienced (n = 202)

Responses	Sub-skill <sup>1</sup>	No. of pupils	Percentage	Rank order	Usage
Sketching	Generating	152	75.200%	1	High
Mindmaps	Exploring	145	71.800%	2	
Moodboards	Exploring	129	63.900%	3	
‘Brainstorms’	Exploring	114	56.400%	4	
Flowcharts	Planning	80	39.600%	5	
Isometric drawing	Developing	65	32.200%	6	Moderate
ACCESS FM	Evaluating	65	32.200%	6	
Sensory Analysis	Evaluating	51	25.200%	8	
Deconstruction	Generating	36	17.800%	9	
4 x 4	Developing	24	11.900%	10	Low
Role-play	Exploring	22	10.900%	11	
Eco-footprint	Exploring	21	10.400%	12	
Extending the product range	Generating	18	8.900%	13	

<sup>1</sup> Sub-skills of design, from the D&T Framework (DfES, 2004)

Winners and Losers	Exploring	16	7.900%	14	
Morphology	Generating	16	7.900%	14	
Beg, borrow, steal	Developing	14	6.900%	16	
PIES	Evaluating	14	6.900%	16	
Walk on the wild side	Generating	11	5.400%	18	
Gantt charts	Planning	9	4.500%	19	Negligible
CAFE QUE	Evaluating	8	4.00%	20	
SCAMPER	Developing	5	2.500%	21	
A day in the life of...	Exploring	2	1.00%	22	
Six thinking hats	Evaluating	2	1.00%	22	
6-3-5 Matrix	Generating	0	0.0%	24	

In response to the limited pupil recognition of the design activities promoted by the D&T Framework, one of the teachers interviewed acknowledged this as reflecting the experience of pupils in that school, but also talked about the wider impact of the training, describing it as leading to a change in thinking about D&T activity and the teaching of design. This had initially been challenging, with concerns being felt about designing at the cost of practical skills. However, this became viewed as balancing creativity with skills and a change in perspective: "it made me not be frightened about trying [new] things."

**Question 8:** "Which of the following statements best describes your preferences in D&T?"

Barlex (2011) has proposed a fourfold model for delivering design and technology activity (Figure 1): designing without making (Barlex and Trebell, 2008; Barlex, 2005), making without designing (Williams, cited in Banks and Owen-Jackson, 2007: 191), designing and making (QCA, 2007: 51, 54, 56, 57) and exploring technology and society (Barlex, 2003). The hypothesis behind this question was that pupils perceive that making is more enjoyable than designing, and that there is limited exploration of 'technology and society' in most KS3 curricula. Table 6 shows the responses to this question broken down by age categories.

**Figure 1** Barlex's fourfold model



**Table 6:** “In D&T I prefer...” (n = 187)

Responses	No. of pupils	Percentage	Rank order
...designing more than making	16	8.600%	3
...making more than designing	92	49.200%	1
...both designing and making, equally	72	38.500%	2
...thinking about the effect of technology on people	7	3.700%	4
No response (discounted)	14	N/A	N/A
Multiple responses (discounted)	1	N/A	N/A

**Question 9:** “Do you have any further comments about designing?”

Participants were given the option to make free comments at the end of the questionnaire. From the total number of responses, 67 participants (almost one third) made comments. These responses were largely positive about D&T activities in KS3, with more than half the responses (36) commenting specifically on their enjoyment of the subject in general, with 4 making comments that could be construed as negative. The remaining comments were either descriptive or neutral in the language used. 24 responses related to making, either relaying it as an enjoyable aspect of D&T or in the case of five that there should be more making or practical work. This relates to the stated preference by more than half the pupils for “making more than designing” (Table 6). 19 responses related to designing, three of these pupils commented on the desire to have more freedom in choosing design projects or aspects of the designing and making process.

There were five comments that indicated a preference for less designing activity, with three specifically citing planning as a dislike:

*“I like technology I prefer making things, planning is boring...”*

*“I would like to make more things and less planning but enough to know what to do.”*

*“Do more practical work than planning.”*

However, these sentiments were not representative of the comments about designing made by other pupils:

*“I think designing is a way of expressing yourself and I like doing.”*

*“I find D and T creative fun designing making and many more [sic].”*

*“I like designing as our own creative minds can make our own things over all I like all of design and technology.”*

*“I think that making an object [and] designing are just as important.”*

*“We should do more things e.g. roll [sic] play, walk on the wild side.”*

## 5. Discussion

Within this study it appears that the association between the skill of sketching and the process of designing remains as a predominant tool for designing, with three quarters of the respondents identifying it as a design strategy used in D&T lessons (Question 7, Table 5). However, when the pupils had been asked, previously, what they were doing when designing the top two responses were related to being creative or using imagination: over two thirds of pupils identified these as opposed to the next highest response, “...draw what I think my product will look like” with just over 13% (Question 5, Table 3).

The difference in response to pupils’ perceptions about designing and their experience might be explained in two ways. *Firstly*, pupils may not be familiar with or repeated the design activities enough time to remember and



identify the specific activities. The top five activities are either well-established D&T (sketches and moodboards) or generic teaching and learning (mindmaps, brainstorm and flowcharts) strategies/tools, and as such would be familiar to most, if not all, D&T learners. Where teachers are using the activities, a different name to that used in the questionnaire might be used, if they are highlighted to pupils at all. *Secondly*, it may indicate that design strategies, such as those introduced in the D&T Framework, are not being used with regularity, if at all.

The band of activities identified in Table 5 as ‘moderate usage’ are all, specifically, D&T design strategies/tools. Isometric drawing and sensory (or attribute) analysis are not named as activities in the D&T Framework for the teaching of the sub-skills of design, but are commonly used in Resistant Materials and Food Technology (respectively). ACCESS FM<sup>2</sup> (aesthetics, consumer, cost, environment, size, safety, function and materials), as an acronym for evaluating products gains recognition by a quarter of the respondents, with *deconstruction* close behind. However, the term deconstruction may be problematic in that the pupils responding may have thinking about the physical deconstruction of products, such as undertaking in an Investigate, Disassemble and Evaluate Activity (IDEA) (DFE, 1995).

Out of the 24 design activities listed, 15 showed an insignificant pupil recognition rate. As discussed above, some of this might be explained by the frequency of and explicit identification by teachers in lessons and the KS3 curriculum. However, with lower than 15% recognition, it appears that pupils’ experiences of design activities are limited to a restricted repertoire of strategies. This is supported by anecdotal evidence of the immediate and long-term impact of the D&T Framework.

## 6. Conclusions:

This small-scale study indicates that the KS3 pupils surveyed have a positive view of design as part of D&T activity. More than two thirds of respondents opted for the “when I am designing in D&T, I am creative” or “when I am designing in D&T, I use my creativity” options for Question 5 (Table 3). This is encouraging when the next most popular response, “... draw what I think my product will look like”, with the less designerly options accounting for a relatively small percentage. An interesting pattern was the low response to the problem solving option. This may be due to the limiting of respondents to one statement, and might have been different had they been asked to put them in rank order or choose two or three, or it might indicate that pupils are not experiencing problem solving activities at KS3. The survey did not ask about the specific design activities (creative or imaginative) pupils were experiencing in schools. This should be taken into account when interpreting the data. However, the intention of the study was to survey pupils’ perceptions and experience of design.

On the other hand, the responses to the question on the design activities (or techniques) experienced are quite revealing. The most recognisable activities (Table 5, ‘high’ usage) being commonly used (either in D&T or in school activities in general) prior to the D&T Framework. It was not surprising (or indeed disappointing) to see the most recognised activity as sketching, as this is tool that is widely viewed as central to designing (Cross, 2011 and 2006). Mindmaps and brainstorm, which are often referred to interchangeably, have become more common across teaching and learning in schools (e.g. Petty, 2009), as well as in D&T (DFES, 2004: 306; Owen-Jackson, 2000: 27, 29, 76). Moodboards have been used with varying success, being criticised where used in a simplistic and unsophisticated manner (Garner and McDonagh, 2000).

Interestingly, only two of the activities described in the D&T Framework (ACCESS FM and Deconstruction) were evident in the ‘moderate usage’ range (none of the framework activities were in the high usage range), with more than 20% pupil recognition (none of the framework activities were in the high usage range). This could be interpreted in two ways: firstly, it could indicate that the impact on the D&T Framework on the teachers in the school was limited; or secondly, that either pupils do not recognise the names of activities or experience different

<sup>2</sup> for a discussion of the use of acronyms in the design education see <http://dtgeek.edublogs.org/2013/04/28/how-design-acronyms-work/>

design activities in their lessons. The former interpretation would be supported by Ofsted (2008: 48) findings regarding the dissemination of the national training programme in 2004. However, the findings do not confirm or refute the later interpretation, and require further study. Should the SPEDL survey be used for further studies, the named strategies in Question 7 would need to be reduced and generalised to avoid the misinterpretation, confusion and fixation on specific activities.

In summary, this study indicates both promising attitudes towards designing and design learning in KS3 pupils in D&T. However, it does question the impact of the D&T Framework on departments in the schools surveyed: this analysis is supported by anecdotal evidence from D&T educators across England. The implications are that this particular initiative, and possibly others like it, has had limited impact on the practice of teachers and the experience of pupils in the participating schools. A factor may be that the survey was conducted 8 years after the initiative was launched, and new initiatives, pressures and/or staff have displaced the good practice. Alternatively, the good practice had not been firmly established as part of the pedagogical frameworks that individual teachers and departments in schools operate under.

The implications for D&T teacher educators, in relation to design learning occurs, are that beginning teachers need support, encouragement to experiment with and engage with design learning activities both in the Initial Teacher Education (ITE) setting (i.e. university) and within the classroom context (i.e. on teaching placements in school). Alongside this, practicing and experienced teachers need support and encouragement to experiment for themselves, and encourage those who they are mentoring to embed new pedagogical paradigms. These might include the four design pedagogical approaches described by Barlex (2011): designing without making; making without designing; designing and making; and exploring technology and society.

In the context of the curriculum review and consultation that was ongoing during the study (DFE, 2013a, 2013b) in England (DFE, 2013a, 2013b), there is an opportunity to review practice and pedagogical paradigms. This is an area where further research is required, in order to develop and contextualise the new approaches to the pedagogy of design.

## 7. Acknowledgements:

Thank you to Ronan O'Doherty, Lauri Thompson, Caz Sumner, Alex Armstrong, Richard Bell and Rebecca Williams for gathering data between September and November 2012.

## 8. References:

- Aldridge, A. and Levine, K. (2001). *Surveying the Social World: principles and practice in survey research*. Buckingham, UK: Open University Press.
- Atkinson, S. (2002). Does the need for high levels of performance curtail the development of creativity in design and technology project work? In: G. Owen-Jackson (ed), *Teaching Design and Technology in Secondary Schools: a reader*. London: Routledge. Ch.12
- Banks, F. and Owen-Jackson, G. (2007). The Role of Making in Design & Technology. In: D. Barlex (ed), *Design and Technology for the Next Generation*. Whitchurch, UK: Cliffe and Company (Advertising and Marketing) Ltd. pp.186-197
- Barlex, D. (2011). An international perspective on design & technology: lessons for the road ahead. In: *NAAIDT (National Association of Advisers and Inspectors in Design and Technology)*, Annual Conference: Design and Technology for all our futures, Winchester, UK, 19-21 May 2011. Daventry, UK: NAAIDT.

Barlex, D. (ed) (2007). *Design and Technology for the next generation*. Whitchurch, UK: Cliffe and Company (Advertising and Marketing) Ltd.

Barlex, D. (2005). The centrality of designing – an emerging realisation from three curriculum projects. In J. R. Dakers, and M. J. de Vries (Eds.), *Technology Education and Research: Twenty Years in Retrospect PATT Conference 2005*. Netherlands: Eindhoven University of Technology

Barlex, D. (2003). Considering the impact of design & technology on society – the experience of the Young Foresight project. In: J. R. Dakers, and M. J. de Vries (eds), *The place of design & Technology in the Curriculum PATT Conference 2003* (pp. 142–147). Glasgow UK: University of Glasgow.

Barlex, D. and Trebell, D. (2008). Design-without-make: Challenging the conventional approach to teaching and learning in a design and technology classroom. *The International Journal of Technology and Design Education*, 18(2), 119-138.

Cohen, L., Manion, L. and Morrison, K. (2005). *Research Methods in Education (fifth edition)*. London: RoutledgeFalmer.

Creswell, J.W. (2011). Controversies in Mixed Methods Research. In: Denzin, N.K. and Lincoln, Y.S. (2011). *The Sage Handbook of Qualitative Research*. London: Sage. pp. 269-283

Cross, N. (2011). *Design Thinking*. Oxford, UK: Berg.

Cross, N. (2006). *Designerly ways of knowing*. Germany: Springer.

DES/WO (1988). *National Curriculum Design and Technology Working Group: interim report*. London: Department for Education and Science and the Welsh Office.

DFE (2013b). *The national curriculum in England Framework document* [online], 8 July 2013. Available at: <https://www.gov.uk/government/consultations/national-curriculum-review-new-programmes-of-study-and-attainment-targets-from-september-2014> [last accessed 8<sup>th</sup> August 2013]

**DFE (2013b). *Draft National Curriculum programmes of study* [online], 3 April 2013. Available at: <http://www.education.gov.uk/schools/teachingandlearning/curriculum/nationalcurriculum2014/b00220600/consultation-national-curriculum-pos> [last accessed 11<sup>th</sup> April 2013]**

DFE (1995). *Design and Technology in the National Curriculum*. London: Department for Education.

DfES (2004). *Key Stage 3 National Strategy, Foundation Subjects: design and technology framework and training materials*. London: HMSO. Available at: <http://webarchive.nationalarchives.gov.uk/20110202093118/http://nationalstrategies.standards.dcsf.gov.uk/node/97671> [last accessed 16<sup>th</sup> July 2012]

Education Reform Act 1988. (c.40), London: HMSO. Available at: [http://www.legislation.gov.uk/ukpga/1988/40/pdfs/ukpga\\_19880040\\_en.pdf](http://www.legislation.gov.uk/ukpga/1988/40/pdfs/ukpga_19880040_en.pdf) [last accessed 10<sup>th</sup> April 2013]

Fasciato, M. (2002). Designing – what does it mean at Key Stages 2 and 3? In: Sayer, S, Morely, J. and Barnes, B (2002) *Issues in Design and Technology Teaching*. London: Routledge Falmer. pp.27-42

**Garner, S. and McDonagh, D. (2000). Problem interpretation and resolution via Visual Stimuli: The Use of ‘Mood Boards’, *Design Education, International Journal of Art and Design Education* , 20(1), pp.57-64.**

Guba, E.G. (1981). Criteria for Assessing the Trustworthiness of Naturalistic Inquiries. *Educational Communication and Technology*, 29(2), pp. 75-91. Available at: <http://www.jstor.org/stable/30219811> [last accessed 13<sup>th</sup> February 2012]

Kimbell, R., Stables, K., Wheeler, T., Wosniak, A. and Kelly, V (1991). *The Assessment of Performance and Design and Technology*. London: Schools Examination and Assessment Council.

Lincoln, Y., S., Lynham, S., A. and Guba, E., G. (2011) Paradigmatic controversies, contradictions and emerging confluences, revisited. In: Denzin, N., K. and Lincoln, Y., S. (eds.) (2011). *The SAGE Handbook of Qualitative Research (fourth edition)*. London: SAGE Publications Ltd.

McLain, M. (2012) An (auto)ethnographic narrative of the teaching of designing within Design and Technology in the English curriculum, *Procedia Social and Behavioral Sciences*, vol. 45, 318-330. Available at <http://www.sciencedirect.com/science/journal/18770428/45> [last accessed 17th July 2012]

Martin, M. and Riggs, A. (1999) Lost contexts and the tyranny of products, *IDATER 1999 Conference*, Loughborough: Loughborough University. Available at <https://dspace.lboro.ac.uk/dspace-jspui/handle/2134/1400> [last accessed 17th July 2012]

Morley, J. (2002). The challenge for design and technology education. In: Sayer, S, Morely, J. and Barnes, B (2002) *Issues in Design and Technology Teaching*. London: Routledge Falmer. pp.3-12

NCC (1990). *Technology in the National Curriculum*. London: Department for Education and Science and the Welsh Office.

Ofsted (2001). *Ofsted Subject Reports, 1999-2000: Secondary Design and Technology*. London: Office for Standards in Education. Available at: <http://www.ofsted.gov.uk> [last accessed 17<sup>th</sup> July 2012].

Ofsted (2002a). *Secondary Subject Reports 2000/01: Design and technology*. London: Office for Standards in Education. Available at: <http://www.ofsted.gov.uk> [last accessed 17<sup>th</sup> July 2012].

Ofsted (2002b). *A Report of the OFSTED Conference for Secondary Teachers of Design and Technology 'Teaching Designing'*, 14 March 2002, Jaguar Cars Limited, Birmingham. London: Office for Standards in Education. Available at: <http://www.ofsted.gov.uk> [last accessed 17<sup>th</sup> July 2012].

Ofsted (2008). *Education for a technologically advanced nation Design and technology in schools 2004–07*. London: Office for Standards in Education. Available at: <http://www.ofsted.gov.uk> [last accessed 30th January 2012].

Owen-Jackson, G. (ed) (2000). *Learning to Teach Design and Technology in the Secondary School: A Companion to School Experience (2nd Ed)*. Abingdon, UK: Routledge.

Petty, G. (2009). *Teaching Today: A Practical Guide (fourth edition)*. Cheltenham, UK: Nelson Thornes.

QCA (2007). *Design and Technology: programme of study for key stage 3 and attainment target*. London: Qualifications and Curriculum Authority.

Rutland, M. and Spendlove, D. (2007). Creativity in design and technology. In: Barlex, D. (ed) (2007). *Design and Technology for the next generation*. Whitchurch, UK: Cliffe and Company (Advertising and Marketing) Ltd. Pages 140-153