MEd Thesis Title:-

Excellence in Design and Technology:

A survey approach to understanding practitioner's conceptualisation of excellence within the context of D&T, in secondary schools, in Norfolk.

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'Thesis is submitted as part-fulfilment of the requirements for the degree of Masters of Education of the University of Cambridge, Faculty of Education'.

Abstract

I am an enthused and committed practitioner who works within a school which performs particularly well in design and technology. Students have achieved significantly improved examination results over the last 10 years, with students winning a number of local and national awards, and the department has forged strong links with local and national industry. The department is now seeking the label of a Centre of Excellence in Design and Technology. In September 2005 the D&T department met to look at the next phase of development. This proved difficult; we had no evidence which we could base judgement on what constituted 'excellence' in D&T; we needed a bench-mark to see how we could improve our practice. After discussing all these issues collectively at our departmental meeting, we came to the conclusion that we could not justify the use of, or promote the title of excellence due to the absence of any standards to measure the outcomes of the department against. More importantly, the theme of excellence, how it can be defined and promoted in a way which is acceptable in society without sacrificing equity required discourse.

The literature review uncovered a need to specify in design and technology what we conceive as excellence in design and technology, to enable us to identify the activity we want to see performed, ***thus excellence could provide us with the notion of what we want to develop in individuals.***

This thesis describes a survey approach carried out in 2007 which was used to uncovering practitioner's conceptions of excellence in Design and Technology within the geographical area of Norfolk. Due to a lack of UK and internationally based research into the attitudes of teachers with respect to excellence in design and technology, the main focus of the study was to uncover practitioner's conceptions of

excellence related to students work using a mixed methodology. The study used informant interviews which were recorded, transcribed and analysed using QRS NVivo 7 as a base for primary research. The primary research created a number of qualitative statements for piloting as an attitude questionnaire. The attitude questionnaire was distributed, collated and statistically tested for validity as a tool for attitude measurement. The statements were found to be reliable (Kronbach Alpha 0.8) and the findings provide an insight into the values and beliefs D&T practitioners collectively hold, relating to excellence, within Norfolk. These include the realisation that respondents highly value creativity in D&T and products designed and manufactured should be tailored to this end in a way which is conducive to the motivation and commitment of the student. This conception reflects the attitude that respondents want their students to be able to think differently about their environment (made world) which will lead to a greater understanding of its needs. Emphasis is based on creating change in the made world (recognised by the field of D&T), about understanding the process of change (manipulating the principles and practice of the domain) and becoming capable of making change (capability). Dimensions to excellence included the need to direct students towards projects which have a moral, social and environmental attributes. The research concludes that a local centre of excellence could be developed and made accessible to all the schools in Norfolk focussed on nurturing creativity within the D&T curriculum.

Declaration

I hereby declare that the sources of which I have availed myself have been stated in the body of the thesis and in the reference and that the rest of the work is my own.

This thesis is 30,000 words long.

Acknowledgements

A special acknowledgement must go to my mentor, Elaine Wilson who provided professional guidance, as well as positive encouragement throughout my time at Cambridge.

I would also like to take the opportunity to thank all the staff in the Faculty of Education, for their support during my studies, with particular reference to Linda Hargreaves, Linda Bott and the staff in the Education Faculty Library.

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1.0 Introduction

I am an enthused and committed practitioner who works within a school which performs particularly well in the subject of design and technology. Although I do recognise that 'performs well' is rather a subjective term. If performance is related to value added scores, performance tables and students wining national awards then perhaps we do perform well, although I have this notion that excellence is much more than this. The department has forged strong links with and sponsorship from industry on a local and national level. This assisted in the development of knowledge, practice and the purchase and integration of resources. The Head of Department is seeking the label of a Centre of Excellence in Design and Technology. The school is in the independent sector which means it does not have access to any valid and reliable method of labelling.

> 'Labeling provides the only means of recognising and exercising excellence'.
>
> Ferrari, M (2002)

In September 2005, our design and technology department had a meeting to look at the next phase of development towards this aim. This proved to be difficult, we had no criteria/evidence which we could base judgement on what constituted excellence in design and technology; we needed a bench-mark, a yard stick to see how we could improve our practice.

This led to a number of questions:-

1. Does the field of design and technology have a definition of excellence? If it does not is it interested in conceptualising, defining and pursuing excellence?

2. What would excellence constitute? Is it bound within the nature of the subject with specific outcomes like designing and manufacturing products?
3. What are the dimensions of excellence within design and technology education? Moral, social, environmental or technical?

The design and technology domain is viewed by the field as an 'interdisciplinary craft' within a 'western culture' then it will contain different reference groups with values and beliefs on what constitutes excellence. We must therefore ask these reference groups about their conceptions of excellence within their specific domain to provide a greater understanding of it and its dimensions. We must also try to understand how excellence is currently measured.

This impression is reinforced by experience of students competing for national awards. One of my students won the Young Engineer for Britain Design Innovation Award, which receives most if not all of its applications from D&T. Upon visiting such an event you will find people making judgments about innovation, creativity, standards of manufacturing. The judges are looking for outcomes which they and others in business view exceed the norm and meet the general criteria which they have set. The criteria includes, designing and making products which successfully meet the need of a specific market. Often students have had their designs patented before they enter the competition. Awards are also presented to students who have sustainable designs or special designs which contribute to society in a positive manner (life saving equipment etc.). This gives additional dimensions to excellence: moral, economic and social value as well as creative and technical capability. If excellence is based on the judgement of experts within D&T and measured purely on the products which students produce and present at competitions,

then how can we ensure that we have the same conceptions of excellence as they do? A simplistic view of what I am trying to understand can be provided by asking, is excellence the surface finish of the product, the products complexity, simplistic function or its moral value and how it contributes towards society? Should we direct students towards small problem solving exercises, which enable large steps towards success (meeting the need of a simple problem) or big problems (serious life changing issues) which often end in nothing more than a little dent in outcome. Should practitioners be pursuing design contexts which are environmentally and/or morally focussed or should they allow students to pursue their own interests as opposed to the interests of designing products for others? How about the educational transformation and life skills which the student has developed, the fact that the student can now articulate their ideas effectively which provides measurement of multiple intelligence as recognised by Gardner, (1983)? Perhaps the student has provided a number of presentations disseminating their knowledge and experience within a group, class, locally or nationally. Perhaps the student has even contributed to forming new knowledge within the department, for example they have made use of a process or technique which the department has not used before?

After discussing all these issues collectively at out departmental meeting, we came to the conclusion that we could not justify the use of, or promote the title of excellence due to the absence of any standards to measure/benchmark the outcomes of the department against. More importantly, the theme of excellence, how it can be defined and promoted in a way which is acceptable in society without sacrificing equity required discourse. We strongly agreed that there is a need to specify in design and technology what we conceive of excellence to enable us to identify the activity we want to see performed, thus excellence could provide us with the notion of what we want to develop in individuals.

1.1 Research Aim

The initial aim of the research is to sample the conceptualisations of the design and technology community in Norfolk relating to excellence. The design and technology community will consist of a range of design and technology specialists' within the independent and state sector.

> Research Question: - What are the current attitudes and beliefs of design and technology teachers on excellence in design and technology.

Long-term aim

The idea of conceptualising, understanding, identifying and rewarding excellence in D&T was discussed with DATA (Design and Technology Association). DATA are interested in developing a centre of excellence status or quality mark. Hence, the initial findings related to understanding excellence in the field of Design and Technology will contribute to the long term aim of understanding the viability of creating a Centre of Excellence or Mark of Excellence in D&T for the UK.

1.2 Why is this Research Needed?

Experience has led me to the understanding that design and technology is an interdisciplinary subject, within a field which continuously evolves, particularly technologically, requiring a diverse range of resources which need to be effectively and efficiently integrated into the curriculum. It is thought that a network, led by those on the very edge (recognised through the use of a title), is the way forward and would assist in the

development of the field. For example, identified specialist's who can have an input into continuous professional development schemes which meet the needs of practitioners.

Because there is little research on the subject of excellence in Design and Technology, the view which I have presented could be just an isolated opinion and not a general need for the D&T community. It is important that the theme of excellence is given discourse to investigate if my opinion is isolated or more general amongst practitioners.

> ***Key point:*** Whatever conception excellence has, it must have clarity and alignment with what constitutes reality for those involved including the perceived value of the reward as a function of effort, commitment and expertise.

1.3 What are the Perceived Benefits of this Research?

This research hopes to provide an understanding into the conceptions practitioners have within Norfolk; about what constitutes excellence related to students work, thus excellence could provide us with the notion of what we want to develop in individuals. These conceptions could provide endpoints or targets for the D&T community to focus its resources towards promoting. The research may also provide an insight to what hinders excellence in D&T. For example, if teachers report that a lack of resources hinder their progress towards promoting high levels of achievement then this will provide a target for the D&T community to focus on.

1.4 Centre of Excellence Status

This approach to excellence should not be interpreted as elitist, it will aim to provide a mechanism to identify and enable access to experts, who work within Design and

Technology. These include specialist knowledge, for example, Electronics, Systems and Control, Resistant Materials, Textiles, Food, Product Design and importantly, experts with experience of developing teaching strategies for students who are gifted and talented and with special educational needs.

It is hope that the way forward is the guided construction of knowledge:-

> "The construction of knowledge through co-operation, continuity and above all collaboration"
>
> Mercer, N (1998)

The purpose of the status will be to focus on enhancing the learning experience of the student by promoting a focus on developing and extending the learning environment through collaborative practice and partnerships. This is also a requirement of the CETL (centre of excellence in teaching and learning) bidding process to obtain centre of excellence status as prescribed by the HEFC (Higher Education Funding Council).

There is a realisation that schools/departments vary enormously in their phases of development and that a great deal can be learned from the experts on the leading edge (Hargreaves, D, 2005). It is recognised (Smith, A, 2004), that a network should be formed to provide a forum enabling greater communication between all major agencies, QCA (Qualifications Curriculum Authority), Ofsted, Local Education Authorities, LSC (Local Skills Council), Specialist Schools, TDA (Training Development Agency). There are obvious benefits of such a structure of identified centres of excellence, with information on specific areas of specialised expertise contained within regions across the country acting as a mapped source. This is

currently happening with the CETL structure in HE (Centres of Excellence in Teaching and Learning, 2005).

> High schools can be intellectually and socially isolating places for teachers. Their organisational structures are complex and fragmented, their programs and staffing are specialised
>
> (Louis, Marks, and Kruse, 1996)

A Math Teacher can discuss issues about the subject to other Math teachers', an Engineering/Manufacturing or Systems and Control Teacher may be the only expert in their field within their school. A network would enable the individual to identify the nearest expert locally within secondary FE, HE and business sectors.

Collaborative Practice

Research based on the benefits of collaborative practice exists within the teaching of science and mathematics. Collaborative practice models encourage practitioners who have an investment in education to be involved in the planning execution and evaluation of teaching within the classroom. An example of this approach could include practitioners from a feeder institution, a local college and a teacher collaboratively discussing sharing and planning lessons.

> The subject requires Technology-centered professional development which has moved beyond the "Here is this application, and here is how it works" to adding "Here are some integration ideas."
>
> Beaver and Moore (2004)

Success in collaboration has been widely reported in the field of math and science although there is little research for design and technology, only the identification of the need. The key to successful collaboration is locating experts in the specific field and gaining access.

> ***Key point:*** Research has found that schools in which collaborative or collegial professional communities do exist among teachers on-going teacher professional development is possible, coherence across teaching practices is created, and collective responsibility among teachers for student learning is cultivated. (Barth, 1990; Cochran-Smith and Lytle, 1999; Grossman et al., 2001; Hargreaves, 1994; Lieberman, 1996b; Louis and Kruse, 1995; McLaughlin and Talbert, 1993, 2001; Newmann and Wehlage, 1995).

It is hoped that collaboration can be extended to all involved in the field of technology who can ***add value*** to the learning process. It is important to note that it is recognised that categories of people exist within the field of design and technology education that will have different needs, views, and beliefs on what constitutes effective ways of sharing ideas.

Why this approach to excellence is needed

There are a great number of perceived benefits to collaboration with respect to design and technology, for example collaborative practice and partnerships are extremely important within the field of D&T. The breadth of information related to the field and the rate of developments within the field place great demand on practitioners. The recruitment of design and technology teachers over the last 10 – 15 years has been from a range of very diverse disciplines. Andy Mitchell at DATA (previously a Design and Technology Lecturer at Sheffield Hallam University) commented

(Telephone conversation, 2006) on the broad range of disciplines trainee teachers of DT enter from. Often these practitioners have rich vocational experience due to their extensive knowledge of often a narrow field within a particular related industry. The depth of experience offered by the applicant could enrich the subject of design and technology and the breadth could be developed. A knowledge base could be used to share such experiences. Collaboration networking can allow access to a knowledge base through links with Universities, access to designers and knowledge of design issues, sponsorship, resources through links with industry and assist with professional development. Collaboration also allows the dissemination of new skills and knowledge to feeders, sponsors and other teaching establishments which builds confidence in experimenting with new strategies in both teaching and the manufacturing of student's projects (CAD, CNC, Casting etc.).

Why Network?

Design and technology is viewed as an interdisciplinary subject, often requiring specialist knowledge in areas which quickly evolve, and within a field which struggles to recruit.

> ***Key point:*** Ofsted (2002b) has found that many secondary schools are having problems in maintaining an up-to-date D & T curriculum. Mostly this relates to ***resource*** and ***INSET*** needs.

A virtual network could be developed to share common specialized information applicable to all technology departments, for example, procedural knowledge, like the use of equipment, increasing access to resources, access to experts including research. Most departments purchase equipment from a limited range of well established

providers. Information generated from experimenting on these machines can be shared - cutting tools, paths, depths, speeds and materials can be accessible via a knowledge base. Efficient and effective methods of combining manufacturing, learning and meeting the national curriculum could also be available. Equipment suppliers, sponsors can post updated information via the system. New approaches to manufacturing like investment casting, silicone tooling can be discussed and shared within the wider community providing supplier information, presentations on the process, time constraints and health and safety. Research will be more efficient with such a system enabling access to thousands of practitioners at the touch of a button.

Why do we need to collaborate locally?

The development of the technology community may have previously been the responsibility of the LEA (Local Educational Authority) Technology Advisor. The advisor would certainly have knowledge of the progress being made by technology departments within the borough. The advisor would be seeking good practice and effective ways of dissemination as well as a range of other duties. Many technology advisors do not exist anymore. This is due to the new restructuring of the TDA (Training Development Agency) previously called TTA (Teacher Training Agency). With this in mind it is crucial that learning communities are formed for the continued professional development of departments within boroughs and the networking across boroughs.

My personal experience of collaborative practice and partnerships has been life long. My experience ranges from networking with industry to obtain information and resources to support students, collaboration for the planning and execution of the

curriculum, to disseminating the learning which has taken place. Recently, our department worked closely with Lotus Cars to improve the teaching of graphics at A' Level with a strong focus on industrial practice. Tony Bushell a Senior Design Engineer gave one-to-one support to students who were designing products on their A level projects. The result of the collaboration provided a real insight to the real world of design; it also improved the quality of the work by the students through the use of techniques and approaches to design. Recently I contacted Tony Hodgson from Loughborough University requesting information on silicone tooling and investment casting. Tony was kind enough to send me some information on the process, materials and issues related to implementation. The information was an excellent source but was dated 2003. The materials and processes currently being experimented with will update this information and should be published in DATA Practice. This sort of research should be easily accessed. How many other teachers were researching such processes? What are their findings? A knowledge base could help to share this information. More importantly it could even direct research into other areas!

Our department has also been involved in acquiring sponsored projects for a number of students at GCSE and A'level to promote a real problem approach to design, as suggested by James Dyson (The Richard Dimbleby Lecture - Engineering the Difference) who criticises education as reducing technology to simple aesthetic remodelling, Using this approach, it is hoped that the design problem set, is owned by all involved, and places more emphasis on the support of the learner through structure and access to resources. Upon the successful completion of the project the students present their results at our Annual Industry Day. The Industry Day is attended by feeder institutions, FE/HE, local schools and local and national representatives from industry.

Would the Centre of Excellence Status be different to any other status which already exists like SST, Academies?

The initial review of literature shows that the status would be different, Specialist School Status is a whole school development model used to ***improve*** the performance of a school, often starting with a curriculum subject, within a school. The acquisition of a specialism is used to promote change (Taylor and Ryan, 2005). The first specialist school to open in England was called City Technology College in Kingshurst. The CTC in Kinghurst was previously viewed as a failing comprehensive school (less than 10% of 5 A-C GCSE) within a socially deprived area. Progress was initially slow (7 years) but new teaching and learning strategies eventually enabled the school to develop into what is [1]viewed to be a leading provider (50%) (Taylor, C and Ryan, C, 2005). Taylor, C and Ryan, C (2005) also go on to state that not all specialist schools perform exceptionally well in their specialist subject and academies will replace failing schools. The design and technology centre of excellence model will focus on recognising our expert specialists in the field. Once recognised they will be networked regionally and set-up a knowledge base to act as a central hub for the continual development of the field. Such a network will also allow for the co-ordination of initiatives, under one umbrella, instead of many of them working in isolation (Smith, A. 2003).

Note:[1] not empirically proved to be leading, (2003 Specialist schools obtained mean average of 56% GCSE A-C).

Key question: Where are our high performing specialist's? Why do we not have a title which recognises them?

What is apparent with regard to specialist school status is the motivation and status of whole school/specialism approach for wanting change. Accountability for that change is not always universal (Rowling, J, R, 2002). A school with a specialism which wants to focus on becoming a leading edge provider is more willing to try out new ideas to develop, and have vision and direction, (Taylor, C and Ryan, C, 2005). What is important is that they receive the correct support and guidance enabling them to make progressive sustainable steps towards success.

A suggested structure for networked centres of excellence

DATA could act as a hub and could be responsible for the administration, funding of research, dissemination of practice and CPD (Continued Professional Development) of the Centre's of Excellence. DATA is capable of developing (with funding) a network of regional centres of excellence within a range of fields within technology – Resistant Materials, Electronics, Food Technology etc. The regional centres will be responsible for the development of learning communities (industry, feeders, HE, applicant for centre of excellence, etc.) and developing the knowledge base via an internet system based at the hub (DATA). The learning communities will have access to the knowledge base. The communities will be schools which have applied for centre of excellence status. They will have access to the knowledge base which includes assessment software which once installed provides a framework for self evaluation (BECTA) providing the base structure for a centre to understand their own areas of development. This could generate a report which will be placed on the knowledge base (accessible to DATA) and will trigger a local support network focused on assisting the department to develop.

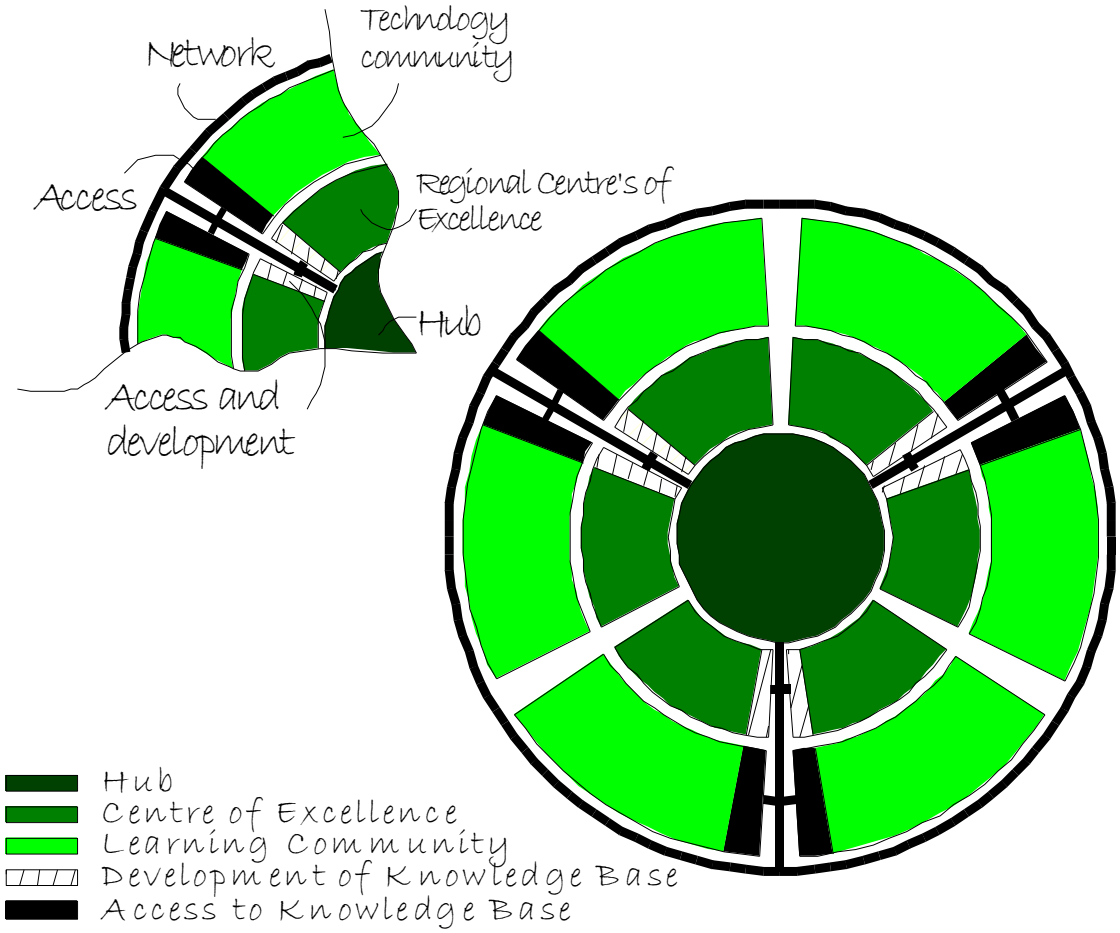

Figure 1.5.1 Centre of Excellence Structure

Summary

Phase one of the research has been outlined including how the results of this research could contribute to the greater aim of finding out if a centre of excellence model for the design and technology is the way forward for developing the D&T curriculum locally.

2.0 Literature Review

This review attempts a two pronged approach by reviewing the nature of design and technology and research on excellence. It will offer the opportunity for information mining and professional reflection in an attempt to understand what exists in the way of literature, and may suggest areas which could be empirically investigated.

2.1 Search Terms and Methods

Introduction

What constitutes high quality evidence is far from obvious especially to the novice researcher. Many books require you to start by clearly stating your, search strategy, inclusion and exclusion criteria, data extraction methods and standards for evaluating study quality and techniques (Fink, A, 2005). Evaluating the quality of the research requires the researcher to exercise critical reflection and judgement, going beyond the mere reporting of facts. Combined with my studies, Poulson, L and Wallace, M (2004) was used to aid critical thinking and draw emerging concepts within the literature for analysis. This was combined with continual reflection on my own practice and how it could be aided by research within the field to uncover issues around the idea of centres of excellence for the design and technology sector.

Limitation of the study

It must be stated at this stage that there is little evidence from experimental research in the field of design and technology related to excellence. There is a paucity of studies in the UK, and the application of strict criteria would have left the review heavily dependent on international evidence. Preliminary searches found that some

research exists on the issues surrounding excellence particularly from the US. Most researchers who report on excellence are either from Business or HE (Higher Education) sector.

Search Strategy

The initial strategy was to identify any models of excellence which currently exist via major agencies (DFES, QCA etc) ensuring that such models do not already exist for the field of D&T. Other curriculum subjects were also researched – particularly mathematics. Reports, although none empirical, were read and sources checked for any underpinning empirical research. A range of online and specialised data bases were searched using key words, descriptors and Boolean logic to identify any major research, reports, journals and books discussing the nature of design and technology and excellence within the primary, secondary and FE/HE sector. This strategy was then presented to a steering group organised by DATA (Design and Technology Association) for feedback. The steering group is considered due to their titles and responsibilities to be experts in their field and prove to be a valuable quality check for the search methodology. The steering group supplied journal reports, book reviews and conference papers for the last 3 years which amounted to an additional 175 documents. All documents were checked including book reviews which contributed to the selection of appropriate material for reading. The books were sourced via Cambridge University Library facility.

Screening

Although criterion was established, adherence to strict criteria for best evidence was frequently not possible. Most reports were included if they were written in the last 5

years, and if the author has at least 5 published reports (Poulson, L and Wallace, M (2004). It was clear by reading a number of reports who the main contributors to the body of research are within the field of design and technology.

Overview - the criteria for inclusion of studies in this review were:

1. Papers published during the past 5 years.
2. Studies relating to primary, secondary and further and higher education.
3. Studies of well-designed rigorous empirical research e.g. empirical evidence which reflects stable phenomena which can be independently verified and ideally reproduced.
4. Papers published in peer-reviewed journals; and government policy documents.
5. Unpublished material provided by the steering group.

2.2 The Nature of Design and Technology

Background

Design and technology was introduced into the National Curriculum as a distinct academic subject in 1990 (under the *Technology in the National Curriculum* Statutory Order, DES and We1sh Office, 1990). Design and Technology subject replaced CDT (Craft Design and Technology). Layton, (1995) suggests that this was a response to Government recognition of the importance of ***technology*** to the ***British economy***, although there is little research which exists on why the replacement was necessary, what is understood by this change, is the view of both government and business, that education is the vehicle which will drive economic and social prosperity. England and

Wales were the first countries in the world to make technology education compulsory for all children between the ages of 5 and 16 (Education Act, 1988). This law was eventually modified in 2002 and D&T was only compulsory for ages 5 and 14.

Interdisciplinary subject or not?

Design and technology is viewed by many as an interdisciplinary subject. This view includes the use of cross curricular teaching practice, for example, design an aerofoil in technology, but calculate the geometry in maths and test it in the wind tunnel in physics. Rutland and Barlex, (2002) state that although closely related to art, technology is viewed as being more instrumental and is thought to have a greater external focus. Kimbell (1997) describes how assessment methods were devised by subject specific working groups set up by the Task Group on Assessment and Testing (TGAT). The Design and Technology Working Group advised on attainment targets and programmes of study for D & T. Representatives from ***science, craft, design, home economics, business & vocations,*** all contributed towards the subject and exerted influence on the working group.

The Core of the Subject

Empirical evidence describing the very nature of design and technology is particularly scarce. This was also the experience of Harris, M and Wilson, V (2003) who conducted a review of literature on the impact of design and technology. The review should not be undermined due to its lack of methodological rigour; it is a collection of views generated from research journals written by those in the field and offers a sample of grounded views which research can build from. Below are a range of citations which are consistent with the findings within the report, except Shield,

(1996) who offers a valid and controversial response to the core of the design and technology curriculum, demanding an empirical approach to what technology does and should include within its remit.

Barlex and Pitt, (2000) states design and technology helps to prepare young people for living and working in a technological world. Children learn the technical understanding, design methods and making skills needed to produce practical solutions to real problems. D & T stimulates intellectual and creative abilities and qualities of commitment and perseverance. It enables young people to relate personal experience to the work of commerce and industry, to understand how design and technology affects our lives, and contributes to the use and development of technology in our society through informed participation.

Kimbell and Perry (2001) note that the task-centred nature of D & T requires a different approach from other curriculum subjects. They believe that the educational elements require pupils to acquire and create new, task-related knowledge while demonstrating their 'active, purposeful deployment of understandings and skills'.

Barlex, (2003) states that the emphasis now is on knowledge which is likely to be useful to developing particular solutions (through focused practical tasks and investigation disassembly and evaluation activities) before pupils tackle a designing and making assignment.

D & T is thought to require a breadth of understanding and social concern and a depth of knowledge and skill, together with a capability to identify shortcomings and take

creative action to improve the made world (Kimbell and Perry, 2001). Kimbell and Perry, also point out that the issue has now shifted from 'passing on knowledge' to pupils 'learning how to learn'. Kimbell, (1997) described this change in pupils' learning as: 'a move from receiving "hand-me-down" outcomes and truths to one in which we generate our own truths. The pupil is transformed from passive recipient into active participant. Not so much studying technology as being a technologist'. This view identifies the subject's project based methodology, where a student works autonomously towards designing and manufacturing a product, which is publicly displayed and must fulfil an externally driven specification, external to the pupil (not made for themselves). The knowledge required to fulfil these goals are selected by the students, unlike other subjects were the acquisition of knowledge is for knowledge sake, propositional knowledge, this is action knowledge, knowledge required to meet an outcome and used as a resource. This aspect to technology is certainly unique to the subject. The amount of autonomy given is questionable; research later viewed in this report provides evidence of criticism towards students who are directed towards less creative projects viewed as safe in pursuit of fulfilling the assessment objectives. Although very limited, it is my experience that once teachers achieve a high standard of outcome with student groups, they will then be more confident to tackle risky, more creative project outcomes.

Davis, (2000) suggests that what first distinguished D & T from other subjects was its framework of assessment (Attainment Targets) which were 'process' rather than 'content based'. Although the development of this 'proactive process-centred view' of D & T has been seen in other areas of the curriculum (e.g. process science and process maths), uniquely in D & T the process defines the discipline.

As identified earlier in the text, the main assessment process within the subject of design and technology is based on project methodology. This requires taking an identified problem/need from a stake holder and developing a solution, generally in the form of a product, using recognised tasks and processes within a number of constraints. The development process is very effective when it becomes iterative, involving mental modelling, trailing, testing and modification of mechanical objects. It is also an effective way of promoting deliberate practice. The uniqueness of the process is that the student must produce a product for the world to see. For example if the problem you encounter is to design a heating and cooling unit for a vehicle, then upon completion, your peers, sponsor, parents, even local schools and industry may critically view your efforts. This is very different to your English coursework whom only your English Teacher may view.

> This project-centred methodology lies at the heart of design and technology in schools and has been developed over the last 30 years into a distinctive model of teaching and learning. This project methodology is rooted in a view of the autonomous learner, taking responsibility for decisions and living with their consequences.
>
> Kimbell, R. and Perry, D. (2001)

Kimbell et al, (2001) believes that project methodology allows teachers to view the 'concrete model' which traces back to the original problem the student was faced with. This allows teachers to trace the thinking processes which have been experienced by the ***student*** and their ***environment***.

> Learners use modelling to bring their ideas into the world and test them; teachers try to observe the modeling for evidence of the learner's design and technology capabilities. A priority for the learner then becomes to record fully and make accessible the modeling with 'oneself' to the assessor of learning: the private modeling has then to function for a public audience that will act in a judgmental capacity.
>
> Kimbell, R. and Perry, D. (2001)

It is important at this stage, to acknowledge the importance of the environment, on the perceived product outcomes. For example, Elmer, R (1999) states "We know it's going to be assessed by someone else, so therefore you're consciously or sub-consciously designing to meet those standards which are set by other people". Design for other people is an important aspect of design and technology but Elmer is more concerned about designing for the public platform and the effects it may have on individual innovation. He states that assessment influences respondents' intentions in general but it influences respondents' modelling in a very specific manner through the authority of the examination by display. Students have a double outcome to consider, one being what their design problem leads them to and the other, what is acceptable within the environment for which it will be presented. This is certainly a valid point which can cause conflict particularly with low ability students who may find them selves being directed towards safe projects which are acceptable within the environment and the assessment process to secure grades. This means that the concrete models being presented may not be representative of the students intentions but are representative of the affect the environment and the assessment process has placed on the student in shaping the outcomes.

Feedback from Nuffield Area Field Officers suggests that students are being well taught, with better candidates getting better grades, but their work generally lacked flair. There is also evidence that teachers give Key Stage 3 students more autonomy in designing and making assignments than at Key Stage 4. This probably related to course work assessment requirements for KS4 (Preliminary finding of Nuffield D & T National Survey 1998 – unpublished results, in Barlex, 1998).

Kimbell and Perry (2001) note that D & T is about 'creating change in the made world; about understanding the processes of change and becoming capable in the exercise of change-making'. The special characteristic of D & T is that pupils learn the capability to operate effectively and creatively in the made world. D & T is an activity carried out with definite purposes in mind, within specific constraints and requiring value judgements at every stage. It has its own distinctive nonverbal ways of thought including use of imagination and imaging.

The particular creative aspects unique to design activity in a technological context are that the person has to imagine a concrete object which does not yet exist, and has to determine spatial and temporal details which cannot yet be observed, but will have to be created by the design and manufacturing process (Ropohl, 1997).

Some citations presented by Harris, M. and Wilson, V. (2003) offer rather a dim view of the subject by stating that conceptual knowledge is absent within the subject and procedural knowledge is the main. It is naïve to presume that what is done is through ignorance and not by using high order cognitive skills, for example, the use of abstract thought, planning, doing, reflecting and modifying ones own action to optimise the

outcome. Personally I view the development process as the most important aspect of design and technology. Making the unique use of being able to profile the capabilities of the student by physically viewing the design problem they have undertaken and comparing this with the solution/s they have provided. Although often a long story it is absolutely unique to the individual and offers a rich contextualised portfolio which is a reliable profile of the students experience and their understanding of it.

Summary

All the citations above focus on promoting mental and physical ***capability*** in individuals This seems to be described as a process which can analyse, synthesize, and create something new through the recursive, reflexive cycle of physical and cognitive modelling, leading to outcomes driven through promoting capability in the use of process based knowledge and practice. It is also suggested that creativity and risk taking is suppressed by the assessment process which may operate in direct conflict with the nature of design and technology. Although this is not the experience of the author it is recognised that different teaching contexts will need to be explored to appreciate the views of others within the field. Capability will need to be discussed in greater depth to understand how it can lead to excellent activity.

2.3 Excellence and Equity

Excellence in education tends to create a powerful debate often providing questions about justifying the aims and purpose of education in general. For example, is excellence in education, as stated by the Scottish Executive (2004a:9) the transformation of important knowledge, development of values, understanding and

capabilities. This may be acceptable if the aims of education are socially and morally shared within the society they are going to be promoted. What is required is an understanding of the socio-culture conceptions of what educations means to those it involves. Acknowledging that we are a western culture, we must recognise that excellence must be fostered without sacrificing equity, both of which are fundamental tenets of a democratic society.

Egalitarians may question the use of a title like excellence which can be viewed as an inequality, Cooper, (1981). To view excellence in this way is justified if it has a negative effect on the distribution of resources and economic progress within society. The aim of the design and technology curriculum in 1990 became focussed on skills which lead to the development of vocational practice for business providing economic prosperity, therefore social excellence may be justified due to the current inability to recruit Scientists, Technologists, Mathematicians and Engineers (Smith, 2004). The distribution of educational resources which target these particular shortages may be acceptable to society.

Borland, (2005) offers some insight into excellence and gifted children. He states that it is morally untenable to use extensive educational resources to identify and support gifted children within the school environment. Although he also states, for which I am in agreement with, that the curriculum must be differentiated to ensure that we develop all students within our reach. This view seems born out of frustration with the American system of running gifted and talented programs and that some institutions use this policy to gain additional resources by simply filling quotas.

Borland, (2005) provides a dichotomy between the need to justify the extended provision of resources and the need of a differentiated curriculum. To offer a differentiated curriculum you must differentiate the time and resources you spend with individuals and/or groups of students in pursuit of supporting their learning needs. He is right to state that gifted and talented whole school programs are not the way forward in developing talent particularly based on single intelligence test (IQ) but to negate the use of additional resources for gifted students is to ignore their identified need. This is a need which Borland reports as not being met.

I believe that specific domain related programmes could be an effective way to provide support for all students irrespective of their ability, providing additional time and resources within the subject to develop and extend the students capability enabling them to succeed. For the students who are gifted, motivated or simply disengaged with school based learning styles, links beyond the classroom often provide students with additional resources, interest, excitement, challenge and the opportunity to display other dimensions of their capability.

Borland states that a definition is not required for gifted children and that they need to be left alone to naturally develop. Giftedness like excellence is a social construct. We must conceptualise and define excellence, like we must conceptualise and define giftedness, to enable us to recognise, direct and differentiate our provision in the knowledge that we are offering a path with support which leads to recognised success. Success is recognised when it is meaningful. If the nature of design and technology is recognised as successful through designing and manufacturing products which contribute to the made world then this is what we should direct our efforts towards.

Borland, (2005) suggests that people who are recognised as gifted and should pursue excellence should not receive special programmes of study which use up resources which otherwise the general population should have access to. I do agree with this principle, but we must also remind ourselves about students who are recognised with specific learning difficulties. It is impossible to imagine that these students should not receive additional support to enable them to succeed. Excellence in education and excellence in Design and Technology is about providing a web of opportunity in pursuit of educational transformation for all and avoiding a one fit curriculum. What this developing model of excellence hopes to recognise is the need to provide a network within the design and technology community which provides practitioners with a knowledge base enabling the sharing of strategies in the pursuit of educational transformation towards a shared definition of excellence. Before this can be provided we must understand what the field views as excellent. This will enable the subject to understand it valued endpoints Mascolo, M.F. et al. (2002), what we should be using to identify and provide in developing the talent of all.

A centre of excellence model which focuses on leading practitioners sharing knowledge and expertise locally, may be a way forward to sharing effective practice which would aid the development of other institutions, bringing about new norms. Hence, excellence is about levelling the playing field not providing additional resources for the minority. It is about clearly recognising those on the leading edge and empowering them to network with those who are not. We cannot expect centres to exercise excellence without the use of a title. Without the title the inequality will still exist, like the master and apprentice, the title must be used to address the inequality bringing equality and creating new norms. For the master teaches the

apprentice eventually bringing about equal status. Without the title the inequality cannot be addressed, labelling must provide the means of identification and dissemination in the view of maximising the educational transformation of all pupils enabling economic prosperity providing social equality.

Summary

Cultures impose normative expectations on their members as apart of accepted practice. It is against these expectations that we judge excellent performance. Copper, (1981) emphasis the need to recognise new levels of excellence and how they create new levels of average performance. If new levels of achievement are created then the expectations of average performance improve and performance in general has a positive effect. Copper goes on to suggest that often what is viewed as excellent or best practice is adopted which create improvements in what we do and how we do it. These improvements raise standards and create new levels of excellence. It is extremely important that excellence and practice develop for all concerned although it is highly contentious to presume that by raising the standard of excellence you will automatically raise the achievement of all students. To raise the standards of all you must understand the needs of students and what is required to fulfil them.

Whatever definition of excellence prevails we should strive to ensure it is representative of the western culture and values which are embedded in our society. It must be inclusive and focus on educational transformation for the good of all.

Excellence must be reflective of the field for which it represents; hence it is the field which must discover it. Research into excellence within the field of design and technology has provided little empirical evidence (evidence which has been scientifically proven and which meets the screening criteria). In fact, it seems that we have not concluded on what we see within the field of design and technology as effective teaching practice (Harris, M. and Wilson, V. 2003). This is also seen as problematic by Mihaly Csikszentmihalyi (1986) for the following reason; "for every well defined domain there exists a well defined and elaborate set of criteria which permits specification of what constitutes excellence". The field of design and technology is an ***interdisciplinary*** subject which encapsulates many domains which consists of different reference groups, crafts, cultures whom have their own values and practises. Is excellence universal in all these associated domains or must they be defined separately? In other words does the systems and control teacher have the same conception of excellence within the field of design and technology as the resistant materials teacher? Do these practitioners have the same conception as the people who make judgements about excellence within the field of Design and Technology?

Initially I believed that surly excellence must be bound in the very nature of the subject, so excellence is representative of what we want to promote as practitioners, what we hold as 'valuable'. This then presents the question; what do we value as important aspects of design and technology education? Again problems arise due to the absence of any clear definition of what design and technology education promotes as a practice and what we as practitioners want it to represent, as Shield, (1996) quiet clearly states:-

'Claims are being made that technology education within our schools is instrumental in enhancing problem solving skills, craft skills and knowledge, aesthetic awareness, graphic and wider communication skills, social awareness and team work (including

combating racial and gender prejudice), scientific and technical literacy, industrial and economic understanding, environmental activism, "life skills" and vocational training. One wonder's what the rest of the school is doing'.

To explore the theme of excellence in more detail we must examine work which has previously been submitted to a body of knowledge by scholars in the field of psychology.

Cognition and the Systems Approach

For many years there has been a divide on agreement to the nature of excellence and is pursuit. Many prominent figures like Guildford (1950) Simon, Borrowski, Peck, and Davidson, (1986) have argued that it is biological and is bound within the cognition of individuals often measured using psychometric testing, while others say that it is a judgment based on individuals and their environment Gruber, Csikszentmihalyi and Feldman, (1986); Ericsson, (2002) and to understand it requires us to understand its social meaning. There is a developmentalist's view that excellence cannot exist outside of its social context, it is not within the brain it is dynamic with the environment, the social expectations which warrant judgement on the individual's capabilities. It is these expectations which shape the individuals abilities in the first place directing them towards mastery. If they succeed then we judge them as excellent, gifted or perhaps talented. Excellence within design and technology may only represent what the field holds valuable in its judgement of excellent performance.

I mention this position to enable readers to openly view my ontological and epistemological standpoint. For the knowledge and means of uncovering it will be based

on understanding of the field which renders judgment and not based solely on the cognitive ability of individuals who operate within it. Excellence will not be seen by looking inside the mind of the players but by understanding the dynamic interrelationship between the individual and what renders judgement of outcome.

> To view excellence as being intrinsic to the individual alone is like focussing on how an apple tree produces fruit by only looking at the tree and ignoring the sun and the soil, Csikszentmihalyi, M. (1994).

If excellence is believed to be based in cognition then a view is generally applied towards fixed ability, in other words ability is fixed at birth. If excellence is social constructed then many believe that individuals can adapt their skills and capabilities in its pursuit. These scholars, including myself, view excellence as a relationship between cultural expectations and opportunities for action and personal skills and capabilities.

Gardner like many other researchers Ericsson, Ferrari, Zimmerman, and Mascolo believe that there is no link between IQ and excellence (Ferrari, 2002), and that intelligence measured by IQ tests only refer to patterns or only measure one dimension of intelligence as opposed to multiple dimensions of intelligence (Gardner, 1983). It is obvious that additional dimension to intelligence must be included in our understanding of excellence within design and technology, for example, emotional intelligence, when presenting a students design brief to a board of directors or the judges of a competition will provide some contribution towards excellence. These skills are highly valued in society yet they are not measured within the assessment of the subject. These dimensions must be explored within the field.

A view that ability is not fixed but can be developed or unfolded through its dynamic interaction with the environment (Plucker and Barab 2005) is inline with a strong sense of professional efficacy and that high performance is available to everybody irrespective of inherent talent (talent which can be developed). Professional efficacy is whether teachers believe that they can make a difference to the learning of virtually every student in spite of obstacles (general teaching efficacy) and whether they hold this belief in relation to their own individual teaching (personal teaching efficacy) (Ashton and Webb, 1986; Lee Dedrick and Smith, 1991; Rosenholtz, 1989). Efficacy is fundamental in believing that every student is capable of learning given the right support and pace. Bosker, R,J, Creemers, B,P,M and Stringfield, S, (1999) state that when teachers believe that they can affect pupil learning, they accept responsibility individually and collectively for pupil progress rather than assigning blame or failure to learn on the student or their home background. Students who believe their ability is 'fixed' direct themselves towards tasks that they believe are 'performance orientated', the difficulty of the tasks are often depicted by what others think of them, if they are capable or not. They avoid difficult tasks which may result in failure. Students who believe that their ability can increase by gaining more skill show 'performance mastery orientation' towards the learning tasks and challenges even in the face of failure Mascolo M.F. et al, (2002). The above view is certainly evident in different culture's providing different attitudes and views on ability.

The need to research deeper into the dichotomy between fixed and variable ability is not beneficial to this report. Even if ability is fixed, intelligence, giftedness and excellence are all social constructs which include or exclude what we view as what we want to develop in individuals. This justifies the need to understand it.

J.P. Guildford (1950) was first to create a blue print for the study of creativity based on identifying particular traits which were viewed as characteristic of creative individuals. As a leading proponent of psychometric testing, Guildford had a vision of a new set of psychometric tests which would be a more accurate method of testing intellectual and non-intellectual traits which could be used for finding new talent. Guildford was convinced that creativity was not the same in one field as it was in another, so individuals who are viewed as creative in one field may not be in another. This was fundamentally different to the philosophers who subscribed to creativity being the same wherever you find it. The next twenty years the US spent significant funds on trying to isolate individual traits in creative people in pursuit of developing psychometric tests which would allow them to systematically select persons of 'superior mental ability'. The approach which was used was unsuccessful and funding was withdrawn. Eventually in the early seventies Gardner, Gruber and Feldman devised a committee which over a number of years grew in number and included – Sternberg, Davidson, Wallace, Sieglar, Horowitz, O'Brien and Mihalyi Csikszentmihalyi. The main theory which arose from the committee in 1984 was presented by Csikszentmihalyi, and is referred to as the systems approach.

Mihalyi Csikszentmihalyi has spent years studying creativity, giftedness and excellence. He has spent the last 30 years uncovering creativity in people. Mihalyi is a psychologist so originally he focused on uncovering the traits of creative people hoping to be able to predict who will be successful and who would not within particular domains. He initially believed that creativity was an individual pursuit and success was based on innate ability. Mihalyi reports that this method is a poor predictor which led him to reanalyse the issue of creativity and giftedness. This led to a focus on the environment and the interaction between that and the person. The systems approach admits that individual traits may be necessary for a person to be recognised as creative or excellent, but it postulates that these

cannot be predicted as prior. It holds instead that one must consider the characteristics of the domain and the field which predicts what a person will be like.

Mihalyi Csikszentmihalyi (1998, 1996) focuses on 3 distinctive vantage points:-

1. The individual, their talents interest and ambition.

2. The domain and cultural sphere within which one works.

3. The field or social system which renders judgment about merit.

The judgment of excellence is based on the interaction of all three vantage points. The manipulation of the domain, which is measured against the field, gives an accurate measurement of excellence. The domain is viewed as a craft within a culture where individuals can be ordered based on expertise'

The Individual, Craft, Domain and the Field.

The Craft is the nature, principles and practice of the activities involved within the domain. For example, Resistant Materials within design and technology would be made up of a number of crafts, many categorised by materials, metal, punch and die process, metal fabrication, wood, wood turning and furniture manufacture.

The individual provides their ambition, motivation, knowledge, culture, intelligence which contribute to how they manipulate the domain. The function of the person is to produce work of a significant standard that it is deemed excellent. This creates new standards in the domain which are eventually normalised. A key question which needs to be answered is - what activity does it take to do such a thing? What is its nature? This is found by looking at what the field believes is acceptable in creating new standards of excellence, what are

they looking for? In design and technology we measure the teachers excellence by the products their students produce and their performance on exams. We don't measure the performance of the technology teacher directly. We analyse the student outcomes and deduce the ability of the teacher from that.

The 'Field' is a social aspect, an entire discipline or endeavour. The field are all the people who can affect the domain. It contains social directors and officers who decide what is credible and can be accepted as worth contributing or modifying the field. The power of the field is generally associated with funding agencies, writers of textbooks, papers, research journals who influence the course of exploration and research dissemination. The field consists of individuals and institutions which that render judgement about the work in the domain. Csikszentmihalyi (1996) states that some fields are hierarchical, that is, the judgement of excellence is made by a small number of individuals, for example, Art where a few powerful individuals make judgements on acceptable quality of work for display in leading galleries. The field decides on the kind of training and the type of knowledge it will disseminate to those entering the field as apprentices. A field often searches to answer questions about its self.. The main question which must be asked of the field is whether the field is searching for understanding (perhaps its nature), change (perhaps a new direction) or preservation. The Chapter 2 provides a strong indication that the field of D&T is currently awaiting a greater understanding of its nature and realisation of what it contributes in the field of education.

The 'Domain' is the cultural aspect, a symbolic system that has a set of rules and practices associated with an organised body of knowledge which is associated with a given field. The function of the domain is to preserve desirable performances selected by the field.

Individuals propose theories, new knowledge, and understanding for the domain which is considered and evaluated by the field. If the new knowledge is accepted by the field then it becomes part of it and is added to the domain. Most examples of the transformation of a domain comes from those who have mastered the principles and practices thoroughly but are dissatisfied with one or another aspect as it exists.

The domain transmits information to the person. The person interprets the information and transmits a variation to the field. If the information submitted is worthy of recognition then the information is disseminated and a change in principles, practice, possibly structure will occur. A simplified explanation follows; I am writing this report which is based on conceptualising excellence and using this to create (in the near future) a case for the introduction of centres of excellence. This information will be presented to the field of design and technology via journals, conferences etc. The field consist of individuals and groups who are viewed as experts, those who give judgment on what should be included in journals, papers and what should be incorporated into policy. If the research is significant enough, for example, it may have an impact on the domain. If this was to happen then a change in either teaching practice, knowledge or some sort of structure within the domain would occur. The field of design and technology includes a large number of domains. For example- domains associated with materials like casting, hence the casting association. So as a design and technology teacher I have given presentation to the casting association on casting in education. The domain of electronics – I teach electronics and have also contributed to the domain of electronics via publications. Design including Computer Aided Design (CAD) I teach CAD including industrial based CAD (Solidworks) extensively and operate within the domain including contributing to publications within this domain. There are lots of other domains that Design and Technology teachers are

involved in, Wood materials and processes, business, educational domains developing pedagogy. A key question to ask when operating within this domain is how difficult is it to create a recognisable *variation? If you understand what the domain views as acceptable variations then you can focus on producing such a variation. You must undertstand the principles and practices of the domain.

*variation is something seen as excellent and warrant recognition.

Let's look at how this is achieved:-

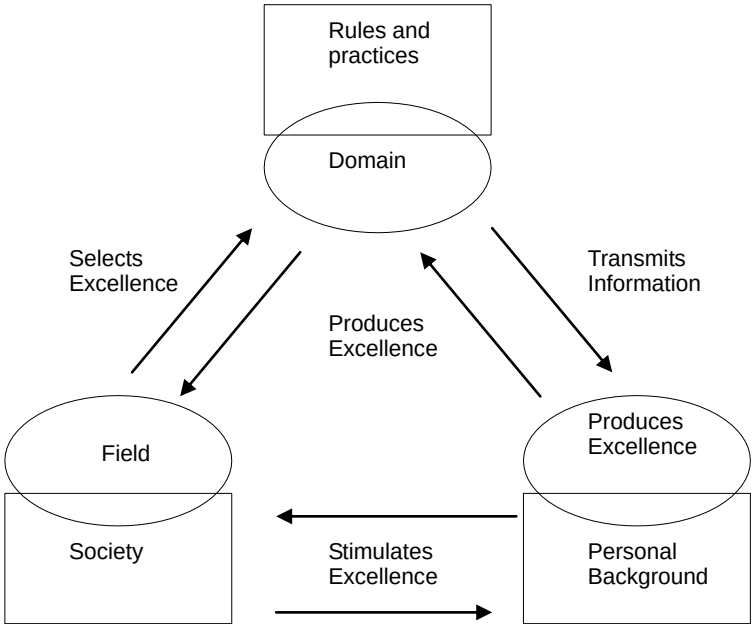

Figure 2.4.1 The systems view of excellence Csikszentmihalyi (1998)

Upon viewing the systems approach in figure 2.4.1 you can see the importance of the link between the domain, field and the individual. When an individual produces an outcome via the domain, it is presented to the field for criticism. Because the field has a view of the outcomes produced within the field, a judgment will be made on whether the outcome is significant enough to be recognised. Often products which are developed from a clear understanding of the principles and practices of the domain will receive this recognition

from the field. These principles and practices are selected by the field. Often how well the field is developed or how powerful individuals are who control it may determine whether a variation will be accepted. Looking at the model in 2.4.1 I suspect that the length of the arrows may represent the time it takes to transmit information between the individual, domain and the field. In design and technology this information may be greatly reduced by networking that process of transference guiding individuals towards excellence. What would be useful is if the three circles overlapped as shown below.

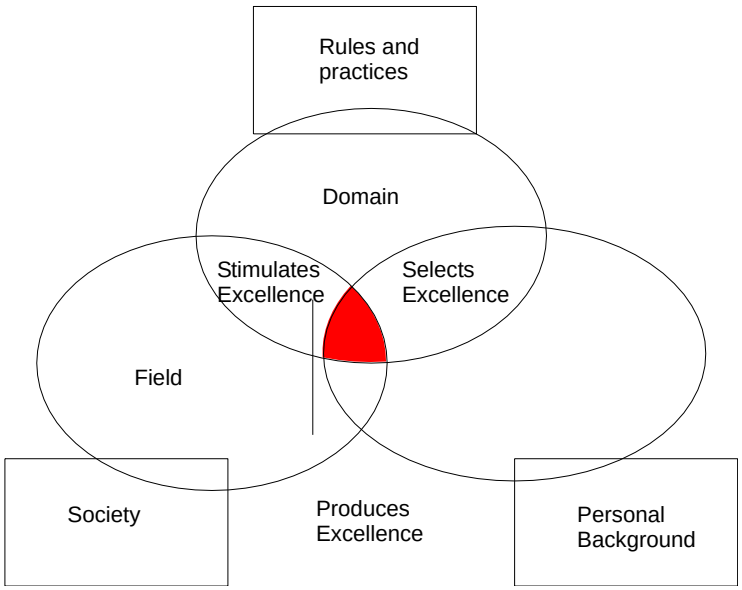

Figure 2.4.2 Modified Systems view

Figure 2.4.2 is accomplished by bringing closer together the field, domain and the individual in an environment which can foster their relationships, a centre which allows experts, individuals and business to be accessed locally.

By working with the field of industry you respond to their requirements. This often requires a department which has successfully integrated their resources, understands and can balance the demands of the assessment process and can include the needs of industrial design and manufacturing.

Practical example

Recently our school won the Regional Young Engineer for Britain Award 2006 and the National Young Engineer for Britain Award for Design Innovation. The submitted project was designed for Lotus Cars. This project brought the field to the school (school visit) and the individual to the field (industrial visit). The project was shaped by meeting the demands of industry. The project was completely designed and manufactured at school. The success of this projects lies within the externally driven problem it was trying to solve and the capability of the individual in solving it. It was industrially based and very challenging which met the approval of the judges of the Young Engineers Competition. Its solution was well supported by the teacher and the industrial supporter who communicated regularly. The student manipulated the domain well enough to produce work which was worthy of recognition. The student in question had mastered a number of domain specific skills or craft to the extent it warranted recognition. The key to the success of this process is that industry is apart of the very make-up of D&T. Making products using industrial processes is a principle aim of D&T practice. Industry represents a significant part of the field of D&T because of all the crafts which they represent. By bringing the industry into a centre of excellence you are bringing the field closer to the individual allowing them to work within a real environment, learning the principles and practices of that environment.

We now need to seek a way of building this concept and limited experience into a workable model for the design and technology field.

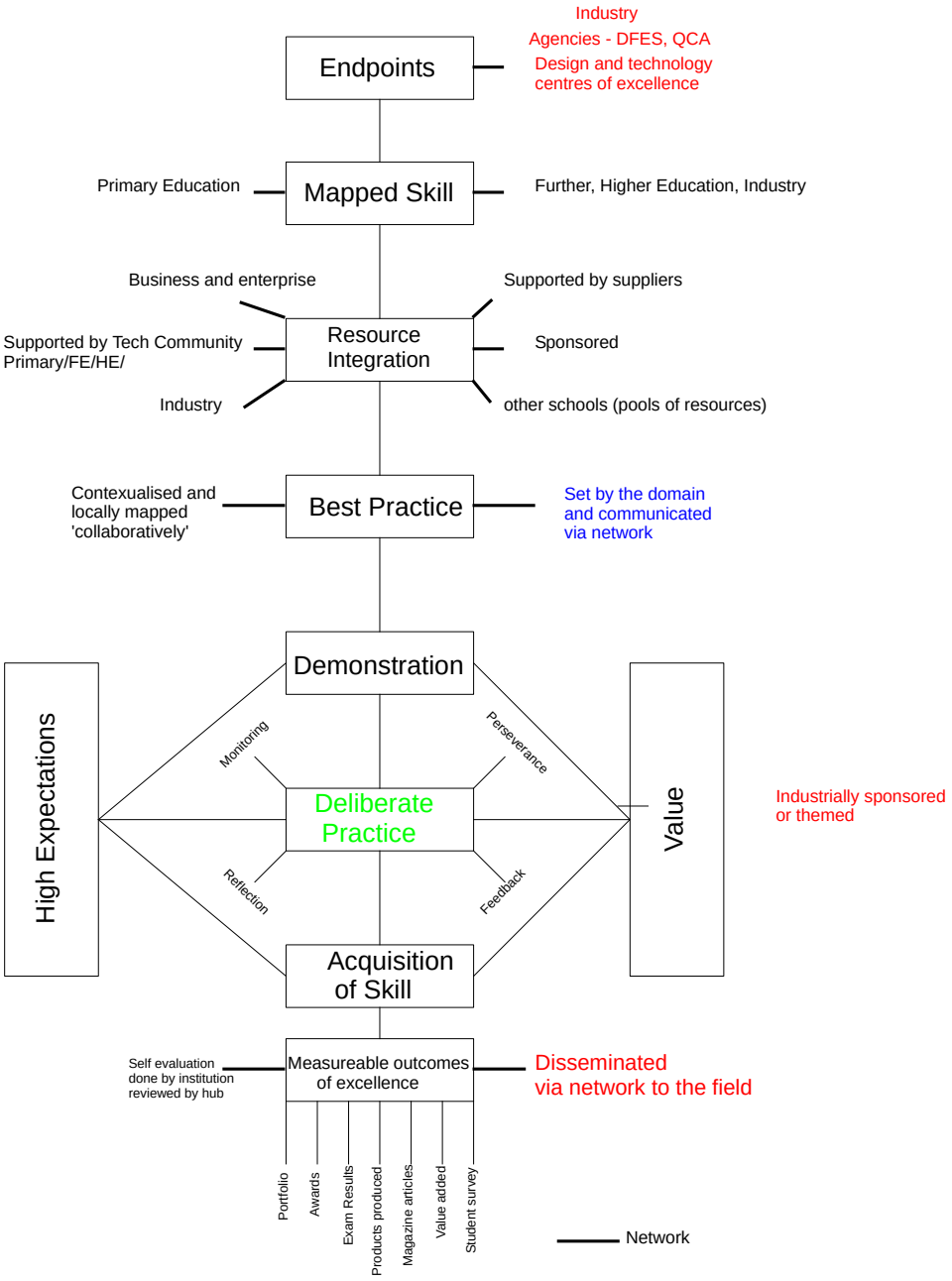

Figure 2.4.3 Conceptual model of excellence based on the work of Csikzentmihalyi (1998)

Key
Red is the field
Blue is the Domain
Green is the individual

Conceptual Framework and Justification

The following conceptual model has been devised from the understanding and application of key emerging concepts contained within the literature review which is reinforced through the work of Csikszentmihalyi, M. (1998). The systems model in figure 2.4.2 shows the important dynamic interrelationships between the field, the domain and the individual. Important attention must be paid particularly in promoting the principles and practices by the domain which are then viewed by the field as judgments of excellence. This must be effective it new standards are to be recognised and new practices promoted. Figure 2.4.3 provides a model which hopes to provide an effective and efficient way of providing communication with the field which will feed directly into the domain which is linked to the individual. Communication with changes in the domain is imperative to aid the development of design and technology department across the country. The slower this process is the greater the gap between the field's judgement of excellence and the principles and practice which direct our students towards excellence and the slower the local development of the subject. This approach brings the field closer to the individual, enhancing and speeding up their development. This approach is also discussed by Siegler and Kotovosky (1986: 418–420,) were they discuss giftedness as having different dimensions for eminent adults as opposed to children at school. They state that adults are judged by their products they produce which are recognised as significant by the field, while gifted school children are identified by school based tests. They stress the need for the adult to be closely meshed with the domain and field to enable successful mastering and manipulation of the craft while children are only tested via IQ scores and judged locally so little meshing is required. Design and technology has become a subject which has a business orientation based on making products for the made world. Excellence is judged on the products produced by the individuals competing. This directs us to the fact

that the D&T subject has the need to be structured in the same way as eminent adults as opposed to school house children. This conceptual framework enables this to occur by making the field and the domain closer to the leaner.

This model begins with a universal understanding of the endpoints which are representative of judgements of excellence which the field of design and technology want to pursue. These endpoints are based on a clear definition from the field on what constitutes judgements of excellence with respect to student outcomes within the subject of design and technology. This includes its conception, dimensions and definition of excellence. These endpoints, as described, must be shared efficiently via a network and discussed locally via the community of practice. It is hoped that such endpoints will allow technology departments to have specific focal points for development both nationally and locally.

Upon the understanding of the endpoints and acceptable ways of measuring the desired outcomes of such endpoints the field can concentrate on the processes required to deliver skills and resources required to pursue them. This will require departments to plan the delivery of the curriculum in a manner which provides a framework of progression for the diverse needs of the student cohort. This can be viewed as a web which has a number of routes to its centre which is supported both in schools, locally within the community of practice and nationally within centres of excellence. Once the department has a plan of the skills which they want to promote they can identify the resources which they require and how they can be integrated.

Best practice is the teaching which the learning community has the ability to feed into, possibly demonstrated locally by a centre of excellence or other centres involved in delivering the curriculum. Deliberate practice at the bottom of the conceptual model is based on how the literature review has put together how expert practice may look. It starts with expert demonstration. This should provide the student with a sense of real value to the activity which they are learning and a level of high expectation which they must demonstrate. Perceived value may be promoted in a number of different ways and often ideas can be fed into how to improve the value of certain tasks using a network. Value is also seen as crucial to promoting perseverance with the task coupled with feedback and reflection by the individual allowing them to understand ways to improve performance. Finally their success provides measurable outcomes which can be disseminated into the public forum.

Summary

It would be useful at this stage of the literature review to summarise some of the findings. As formulated by Csikszentmihalyi (1996), excellence emerges by virtue of a dialectical process among individuals of talent, domains of knowledge and practice; and fields of knowledgeable judges. To understand excellence is to understand the individual, a study of their background and what renders judgment of their efforts. For a more simplistic explanation, excellence can be approached from a number of different prospectives; from that of the person carrying out the work (student), from the analysis of the product which arises from their efforts (product, portfolio, exams), from the processes in place which bring about the product (institutional resources, structure, practice, culture), or from the response of others to the existence of the new product (judges of competitions,

moderators/examiners, e.g. leaders in the field of D&T). Each prospective will bring about new insights into the nature of excellence. Ideally all of these prospectives must be investigated. This report focuses on understanding excellence from the prospective of student outcomes (project work) which are viewed as excellent by the field. D&T does not have a definition of excellence in D&T. It is currently undefined with respect to what it describes as ultimate performance. This will require research focussed on practitioners conceptions in the field of D&T. To understand these conceptions will require not only the need to sample attitudes, but also to view the products they describe as means of understanding the impact these products may have on the field. It seems from the literature review that to uncover teachers' conceptualisations towards what they hold as valid will uncover the direction and endpoints which teachers want to promote. Teachers will arrange their resources and promote what they think is important in D&T. Viewing the products students produce will provide an understanding of what teachers want to promote in students and how successful they have been in promoting it. This will uncover how successful teachers are in nurturing talent enabling them to understand and manipulate the principles and practices of the domain to produce work which is viewed by the field, as excellent.

Defining Excellence (working model)

It is important to be explicit by defining your conception of excellence. Your definition will identify the way you frame the very lens you seek understanding from. Your definition is like a torch, it will uncover what you view as excellence through the direction you point the torch and how you interpret what it uncovers. I see design and technology as critical in offering students the ability to extend learning beyond the classroom through collaboration, reducing simulation and providing real experience.

My definition of excellence is reflective of the literature I have reviewed and my experience as a practitioner. The model is based on developing capability relating to creativity, problem seeking and problem solving. This promotes educational transformation which is measured by reviewing the students' products they produce, portfolio they have created and their level of interaction in the made world.

Let's discuss this definition in greater detail:-

Capability

Capability is widely discussed and reviewed in design and technology. Gagne (1984) provides a useful analysis tool with his 'five varieties of learned capabilities' which the subject promotes. Intellectual Skills – this is 'knowing how' to do things, or procedural knowledge. In the context of D&T this includes, for example, knowledge of materials, tools and processes for specific applications. Verbal information – this is a capability concerned with how to communicate what a person knows. A person should be able to state or tell a fact using writing or words. However in D&T we need to add drawing, prototyping, sketching, and indeed any kind of presentation work produced by students would come into this category. Cognitive strategies – this capability can be described as learning how to think. Cognitive strategy is a capability which the learner acquires through managing their own learning, Zimmerman (2002) refers to this as a self-regulatory process. Motor skills – Gagne's clear definition is a capability to perform physical actions with purpose. He gives examples (1984:48) of threading a needle or throwing a ball. In the D&T context this capability is concerned with the extensive range of practical skills. Attitudes – is the capability to develop preferences or an affinity for a certain subject or specialism. In D&T this forms the basis for

developing expertise in working with a particular material, technology or developing aesthetic preferences.

Promoting technical and creative capability in individuals is believed to be at the heart of the design and technology process. This is further emphasised through design and technology competitions which look at students projects and measure the creative and technical attributes of the product they have designed and how this design meets the needs of the made world (the world of manufactured products measured against their domain related standards). Technical capability is easy to define in design and technology; it is relatively easy to see a product which has been well manufactured, particularly as it can be measured against a specification. Developing excellence in technical capability will be representative of the integration of resources the department has provided (knowledge and practice), their deliberate practice (how they purposely structure and deliver the curriculum, pedagogy) and the culture of the organisation. It will also be representative of how the teachers conceive what an excellent project consists of. This allows them to structure their knowledge and resources towards valued endpoints. It is these valued endpoints that competitions measure as a mark of excellence; they are also the endpoints which I hope to capture and understand.

Creativity

Creativity is more difficult to describe, it has not been empirically defined within the subject of design and technology. Perhaps the field will assist in providing a greater understanding of what they see as creative in the judgments being made about excellence. Creativity seems to be linked to divergent thinking, doing things differently, looking outside the box. Creativity is bound in a judgement about whether

something which has been made to fulfil a problem which has been achieved through creative problem solving.

Developed in all

The notion of developed for all is that the teacher will focus on developing all students within their charge. This provides a need to offer a web of strategies encouraging participation from students with a range of abilities, interests and needs. Educational transformation provides the measure of excellence which identifies the mileage students have made during their activity. This is assessed by their portfolio of work and examination of knowledge.

Problem seeking and problem solving and products for the made world

The project methodology is central to how we assess student's knowledge and understanding within the subject of design and technology. This requires taking an identified problem/need from a stake holder and developing a solution, generally in the form of a product, using recognised tasks and processes within a number of constraints. There is also a drive towards finding problems which have moral and social dimensions to them. Products which contribute to society, the environment or even world poverty will far well in judgments of excellence. In the assessment of excellence, judges are viewing the development process which the student has completed as a means of understanding how they arrived at their outcome. The uniqueness of the process is that the student must produce a product for the world to see. For example if the problem you encounter is to design a heating and cooling unit

for a vehicle, then upon completion, your peers, sponsor, parents, even local schools and industry may critically view your efforts by identifying the problem you was initially faced with and how you overcome these limitations. This process is very effective when it is iterative, cyclical involving mental modelling and the trialling, testing and modification of objects.

How is excellence identified?

Howard Gardner cited in Ferrari, (2002) suggest there are a number of ways of identifying excellence. It could be a measure of the number of home runs, best sellers, or from an informed individual who selects the winner of the Nobel Peace Prize. In the field of Design and Technology it may be based on the winner of the Young Engineer for Britain or DATA Teaching Awards. Some of these outcomes may have their own set of criteria on what constitutes or defines excellence in design and technology.

Gardner notably draws evidence for excellence from both quantitative and qualitative sources, Gardener uses an ideographic approach by focussing on what the field views are their key players. He produces biographical accounts of individuals looking for any correlations between traits. This approach is widely reported as being flawed due to absence of the study of the individuals interaction within the domain. In other words it is not dynamic enough to explore excellence in its natural state.

Ericsson (2002) (Florida State University) who discusses, in the pursuit of finding excellence in a domain, you must find the objective mediating mechanisms. Ericsson prefers to create laboratory type environments monitoring variables which are defined in advance and measured in simulated environments (e.g. Chess competitions). He later defines this as practice which can be objectively replicated producing the same predictable

results. Ericsson uses his empirical research with chess players to identify excellence. Using chess as an example, a competition for chess players would allow entrants to compete in a laboratory type environment (the venue) using their knowledge and experience (previously gained) using the same physical resources (chess board) allowing the winner to be acknowledged as an excellent player. This could certainly be as an objective method (repeatable giving the same or at least similar results) of measuring excellence with respect to isolating as many influences as possible which may effect the end result. If we look at the winner and their background we may find that the student may have developed expert practice through a self regulatory process (a way of focussing on their own weakness to improve performance) or may have received expert deliberate practice (practice which is objectively seen as promoting expert performance) or they may have some innate ability to perform well at these types of activities. We may find elements of all three.

Let's now look at using the measurement of student's products within a competition type environment. A student's product is representative of the capability of the individual and the institution which it has come from. This is often representative of the value schools place on the technology curriculum, the amount of resources the institution has and the expertise of the teachers and their conception of what constitute an excellent project. So are we objectively measuring the capability of the student? My experience at the Young Engineers for Britain Award 2006 directs me to students who produced some excellence concepts but due to the capability of the institution they represented did not manage to make functional prototypes. These restrictions are placed on the student not inherent within the student. Some students were disregarded due to the nature of their projects, their may have designed and manufactured a piece of furniture or a child's toy to a very high standard. There projects received little recognition. This failure possibly also existed due to

different conceptions of what makes an excellent project by teachers in Design and Technology and Engineering. Also no criterion was applied for the measurement of educational transformation, although this may have been done by the judges it was not explicit. The criteria is focussed on the product not the students.

We must understand and openly define excellence so we do not eliminate those who show promise within a domain (Csikszentmihalyi, M. (1994).

Summary

The Design and technology curriculum went through a radical change in the 1990's. Now it seems that the model which has surfaced seems driven by political imperatives than a general academic base for learning about designing and making. Design, technology and engineering have become instrumental in assisting the government to compete on an international basis. In some ways you could say that Design and technology has become vocational, aligning itself with the FE and HE sector requiring a focus on providing real life experiences instead of simulation. This often requires networking locally providing links beyond the classroom with business and enterprise. Students are encouraged to have real design problems which often require real clients. Products are designed for clients who evaluate them and make judgements on suitability and levels of success. Moral and social value, within the subject, is embedded in judgments about what to design and what impact it may have on society. This impression is reinforced by experience of students competing for national awards. Although it is recognised that national competitions have their own criteria, the Young Engineer for Britain Award receives most if not all of its applications from DT. Upon visiting such an event you will find people making judgments about innovation, creativity, standards of manufacturing. The judges are

looking for outcomes which they and others in business, view as exceeding the norm and meet the general criteria which they have set. The criteria is mainly focussed on designing and making a product which could be patented and put into production due to it meeting a client/market need. Often students have had their designs patented before they even enter the competition. Awards are also presented to students who have sustainable designs or special awards for designs which contribute to society in a positive manner (life saving equipment etc.). This gives additional dimensions to excellence – moral, economic and social value as well as creative and technical capability.

These dimensions to education are also reinforced by the likes of Seymour (2004), Chomsky (2003) who describes the need to include in education, for the purpose of humanity, due to the present course of unprecedented environmental destruction, issues like - environmental awareness, poverty, population and consumption. Seymour states that students must have these dimensions included in their education to provide a sustainable future. Although it brings to question on whether morals can be explicitly taught with an educational setting. Design and technology subject area can lend itself to embedding these dimensions through initiatives like Practical Action who provide environmental awareness with respect to making products. This does require a change in the way we assess and award products which are produced for tackling environmental issues. The products produced may look very different to what is generally produced within the field due to different levels of effort being applied to different dimensions of what is seen as an excellent product. For example, they may be made of a single recyclable material or a material accessible in a remote part of the world. More effort may be in its design than its manufacturing. This could

create problems for some resistant material schemes which are controlled by examination boards that generally prefer to see a range of materials and processes. Of course embedding these environmental issues into design and technology subject offer insights into moral values but are not the teaching of a moral education. For example we cannot teach:- 'I will care about the environment' but we can apply dimensions with social environmental and moral application if this is what the field of practitioners want and are able to provide.

If excellence is based on the nature of the judgement of experts within the field of Design and Technology and measured purely on the products which students produce and present at these competitions, then how can we ensure that we have the same conceptions of excellence as they do or visa versa? Misconception could and probably does lead to a very negative experience by some students. Imagine little Johnny takes his product to the national competition to be viewed by the public and people who are judged to be leaders in the industry. The student acknowledges that he has wasted his time due to the fact that the teacher who sent him has a different conception of what constitutes a worth while or even excellent project. Misconception is damaging to the aspiration of young technologists, engineers etc.

We need a well defined accepted definition of what constitutes excellence in Design and technology and the crafts it represents otherwise we will continue to wonder blind in identifying and directing our talent and developing our resource base through decisions based on hunches and hear say instead of reliable empirical evidence. This is of course if we want to pursue excellence in the first. What is apparent is that we must avoid having different conceptions of excellence within the same field. Once we agree on our

conception of excellence we can find out if this is representative of the field which promotes D&T and the mechanism which measures it.

This report will focus on understanding excellence related to student outcomes for the purpose of understanding what practitioners want to promote in the individuals teach.

This leads us to our final research questions ready for the methodology section.

Final Research questions:-

1. To understand, through the use of research, Design and Technology teacher's conceptualisation of excellence bound in students work within Norfolk.

2. What dimensions exist within these conceptions? In other words, are we seeking to promote humanitarian understanding or technical competence?

3.0 Methodology

Introduction

We rely on experience and authority to come to terms with the challenges of day-to-day living. What is seen, heard, felt, touched is a part of the essential data of experience. How an individual perceives the world is never a simple matter of opening your eyes and just looking, the biography of the person looking is often implicated which is dynamic with the field for which they function within, the human lens is organised culturally and psychologically.

There has been conflict for many years towards paradigms which are used to describe how we construct our world view and belief system. The dichotomy between the positivist paradigm and their accompanying methodologies (a single reality which can be objectively understood by the researcher) and constructivist/interpretive paradigm and the accompanying methodologies (accepting multiple realities through the subjective understanding of those in the field) has been going for such a long time that new methodologies are beginning to emerge, for example, The Pragmatic Approach; the use of whatever philosophical or methodological approach which works best for a particular research problem (Tashakkori, A. and Teddlie, C. (1998: 11). Robinson, C (2002:43). The need to understand and locate my paradigmatic prospective will allow readers to understand how I directed myself towards the research tools which I selected to uncover the phenomena I was seeking, and how I presented what I have found. As a researcher, I see the need to present my world view as a route to providing an open understanding of my biographical lens which I use to understand the world, seek truth and build knowledge; my ontology and epistemology. It is important to recognise that research methodologies are essentially drawn from a

researcher's ontological and epistemological theoretical prospective. These prospectives affect the way in which the world is interpreted and researched. A personal prospective will affect which facts we see as relevant and important and how we go about interpreting them. Many researchers will look at the same phenomena but from a different prospective in pursuit of understanding and truth.

3.1 The Theoretical Prospective,

Excellence is viewed as a social concept, hence it is representative of what practitioners value as exceptional performance within a domain. A domain is shaped by the background and culture of the individuals who function within it. This is why it is important to attempt to understand how those individuals view excellence and how these views collectively contribute to understanding excellence within the D&T domain.

Excellence is viewed to have universal laws applied to domains, which if mastered can produce ripples which effect the way that the domain may function; view its standard of work or apply it's principles and practices. In simple terms many design and technology departments may state that they perform to a standard of excellence but unless it is recognised by the domain it will not be recognised beyond the school, often not even beyond the department. This means that excellence must be linked to a single reality which if understood and exceeded will produce new standards of excellence in the field. If excellence was related to multiple realities then any individual interpretation of excellence would affect the way the domain is shaped. By understanding the principles and practices of a domain, only then can you produce work which is recognised as excellent.

The research paradigm which I align myself with is post-positivist. I seek the understanding of a single reality and I am looking to find how different reference groups construct this. I also understand that it is difficult to be value free when carrying out research particularly within certain contexts, however there is still a commitment to objectivity which is approached by recognising the effects of these likely bias's. As a researcher I am looking to produce 'norms' from the research findings which represent the technology community. Emphasis is on producing statistics stating how many respondents said x or y. Although the paradigm is post-positivistic it uses a mixed methodological triangulation involving the use of quantitative and qualitative methods of data collection and analysis to study the same phenomena within the same study (Tashakkori, A. and Teddlie, C. (1998: 18). Table 3.1.1 shows how postpositivism is compared to positivism and constructivism.

Paradigm	**Positivism**	**Postpositivism**	**Constructivism**
Ontology	Naïve realism.	Critical or transcendental realism.	Relativism.
Epistemology	Objective point of view, knower and the known are dualism.	Modified dualism, findings are probably objectively true.	Subjective point of view, knower and the known are inseparable.
Axiology	Inquiry is value free.	Inquiry contains values which can be controlled.	Inquiry is value bound.
Methods	Quantitative.	Primarily quantitative	Qualitative.

Table 3.1.1 Comparison between the two main paradigms and Postpositivism.

3.2 Research Methodology

The research methodology is based on a descriptive survey which was used to gather data which is representative of the cross-section of the technology community and describes the current attitudes of practitioners with respect to excellence. Changes in theory related to giftedness, creativity and excellence (see literature review) have required the analysis of the field of function and the dynamics of the player within the field of operation. This research supports this view and will aim to describe practitioner's values and the dimensions which exist related to excellence. This means to understand excellence we must analyse what ***we hold as valuable attributes of what we want to develop in others*** and how this is seen as an outcome.

With this in mind the research questions are as follows:-

1. What are Design and Technology teacher's conceptions of excellence within the subject of design and technology? In other words, what do teachers want to promote in the individuals within their charge in pursuit of excellence?

2. What dimensions exist within these conceptions? In other words, are we seeking to promote humanitarian understanding or technical competence?

Variables/categories

Practitioners are identified as individuals who work within different crafts – resistant materials, product design, food technology, systems and control and different domain/cultures –secondary state and independent within the geographical area of Norfolk. I also identified variations within these categories for, example, gender,

years of experience, status, examination results within the department to see if teachers' backgrounds contribute to any variations in their attitude towards excellence in D&T. Students work is described as the products which they produce, examinations they sit, competitions they compete in and any other outcomes the field uses to judge excellence. The conceptions of these practitioners with respect to excellence focused on student outcome.

3.3 Justifying a Survey Approach

Survey research entails the collection of data which generally consists of a number of variables/categories often recorded at a single juncture in time. Surveys are characterised by the structure of this data which is referred to as variable by case matrix. This means that information is organised as cases, in this instance people, which have characteristics of a range of variables. An example of a variable is gender and a category which is within this variable would be, male or female.

Often the aim of gathering this data is to either, systematically produce a body of quantifiable data, in respect of a number of variables which could be examined to discern patterns of association or to describe a situation or context (Bryman, 1989). This research is descriptive, so its principle function is to describe its findings.

This means that the primary function is to uncover exactly what conceptions practitioners have about excellence in the field of design and technology. It is important to note that the success of the survey method is achieved through tackling the complexities of sampling, wording questions and coding answers, also ensuring that all this is piloted and checked for interpretation and those questions are matched

effectively against the research question and methods of data presentation. Mishler (1991) states 'there is a difference between answering questions in a naturally occurring situation as opposed to a questionnaire type environment'. Many researchers also state that interview bias exists which may affect the response of participants. To combat this, the use of mixed methods has been used to provide both qualitative information from informant interviews and quantitative information from a questionnaire. The attitude statements within the questionnaire are directly linked to the informant interviews to ensure that they are grounded in the findings and not interpreted by the researcher. The combination of one-to-one interview and a self complete questionnaire has provided a rich source of data.

My literature review shows that data on attitudes to excellence in D&T does not already exist in the field of Design and Technology. Research exists focused on Students Attitudes Towards Technology (PATT), but no research exists, to date, on the attitudes of practitioners on excellence relating to students work. This requires the research to be based on information directly sourced from the design and technology community.

A survey approach was also supported by DATA. DATA have access via email and publications to a range of practitioners in the field of D&T (due to membership of the association). This provided me the opportunity to write reports for publication on excellence in D&T discussing some of the issues within the literature review before I conducted my informant interviews and distributed my questionnaire.

The data produced from such activity is not complex or sensitive which lends itself to descriptive survey research approach. A descriptive survey is low cost and quick to administer using DATA's resources.

Strengths and weakness of methodology

de Vaus, D. A. (1999), reports on a number of weaknesses relating to the use of a survey methodology:-

1. Surveys cannot adequately establish causal relationships between variables.
2. Surveys are incapable of getting at the meaningful aspects of social action.
3. Surveys just look at particular aspects of peoples' beliefs and action without looking at the context in which they occur.

Point 1 is a criticism of the experimentalists, where the use of randomised control groups are emphasised in proving or disproving causal relationships. A survey is an appropriate research design in this instance because I wish to generalise from my findings in terms of frequency or the prevalence of a particular attributes or variable with a small sample. Points 2 and 3 suggest that surveys struggle to get to the meaningful aspect of social action, for example, to find that women tend to be more religious than men, does not provide insight into why. To counter this criticism, informant interviews were used to understand the respondents' conception, their actions and their environments. This has all been recorded, transcribed (qualitative data) and analysed using QRS NVivo 7 to develop the questionnaire. Generalisations are extracted by analysing the questionnaire using software package SPSS Version 15.

The analysis and conclusion for this report is drawn from a combination of both the informant interviews and questionnaire results.

3.4 What about an alternative research design?

I could attempt to scientifically test design and technology teachers in a laboratory type environment as described by Ericsson, (2002) to uncover the objective mediating mechanisms which promote excellence. Excellence is not viewed as being intrinsic to the individual, it is viewed as dynamic with the environment, and hence it can not be divorced from it. The research questions are not susceptible to scientific experimentation because no causal relationships are being sort, only opinions and values. In other words we are not seeking to uncover casual relationships but trying to uncover beliefs, values and opinions which contribute towards peoples' attitude towards excellence.

A case study approach could be used to focus on an institution which underpins good practice looking for generalisations which contribute to their activity in the support of pursuing excellence. This would require the researcher to look at excellence in practice and attempt to create variables from its activity. The selection of suitable technology departments would be based on opinions from experts in the field or statistics on the performance of the UK's Technology Departments. This information may be available but is not easily accessed due to confidentiality of data, related to ethics. We cannot identify departments which are excellence until we agree on what constitutes excellence. Until we understand what the field of D&T holds valuable we cannot identify the departments which promote this activity.

3.5 Research Methods

This research uses mixed methods (quantitative and qualitative) and the instruments applied are informant interview and questionnaire. The triangulation of findings is also achieved through the combination of quantitative and qualitative research.

The researcher wanted to be as close as possible to the practitioner's and the products they were exemplifying to discover their nature and interpretation (Robson, C. 2005), hence the research was grounded in the field of discovery.

The initial phase of the research using an informant interviews (qualitative research) was critical in assisting with the development and piloting of an attitude questionnaire (quantitative research). These interviews were used to uncover the language (hermeneutics) used by practitioners and to identify and record, using a camera, the work which practitioner exemplify. The questionnaire was constructed to sample a more generalised view of excellence by extending the field of research.

3.6 Instrumentation

A five step process will be applied to operationalise the instruments for this research Fraser, L. and Lawly M. (2000:19). This is based on:-

1. Determine the required information (from research question) being sought and from who.
2. Determine the type of instrument and the length.
3. Prepare the draft question content, wording, response format, structure and layout.

4. Pre-test/pilot and revise.
5. Assess reliability and validity.
6. Administer.

The most efficient instrument to use due to cost and time were local interviews and a questionnaire, Fraser, L. and Lawly M. (2000). The survey questions (interview and questionnaire) were directly linked to the research questions (see Table 3.10.1).

These questions were used during the interview stage with 3 schools in Norfolk. The interviews were transcribed in word and analysed using QSR NVivo 7. An item pool was created which was filtered and structured to construct attitude statements in QSR NVivo 7. A pool of attitude statements was used to construct the attitude questionnaire.

3.7 Informant Interview

In order to ensure that teacher's accounts are grounded on the actual work produced by students and provide the ability to probe deeper into practitioners attitudes it was recognised that an informant style interview should be conducted.

> A study focusing on the meaning of particular phenomena allowing both the interviewer and the interviewee to be apart of the process.
>
> Robson, C. (2005: 271).

An interview, based on purposive sampling, was recorded and transcribed with 3 local schools in the Norfolk area. These were informant style interviews which had the

principle feature of minimal control enabling individual to fully express their subjective feelings. This allowed me to experiment with a number of differently worded questions and measure their effectiveness. This also enabled me to probe deeper into the perception of individuals with respect to the values they hold in relation to excellence. Below is an example question which was used to try and probe deeper into practitioner's judgements about excellence:-

You are judging a competition in design and technology, two students are in the final, one has designed a CD rack and the other has designed a Bird Feeder. Both of the designs are well manufactured. What additional criteria would you apply to make a judgement about who should win?

The practitioners were asked to provide evidence of what they believe to be excellent work which students have produced. They were encouraged to describe their thoughts on why the work is viewed as excellent leading to a definition and the understanding of the dimensions of the work. Pseudonyms are used to protect the identification of the schools involved in the interview process. The selection of the school's was based on their profiles and willingness to take part in the interview.

Material development informant interview

Initially, a bank of questions related to the research questions and literature review were developed and checked by a steering group (linked to DATA, Design and Technology Association). I also wrote a report on Excellence in Design and Technology (See Appendices) for DATA to stimulate interest and provide some background information on issues surrounding the subject of excellence. This report

was used to give the key informants some background knowledge on issues related to D&T before they were interviewed. The report was published 3 weeks before the start of the informant interviews began. The publication is sent to about 6,000 members of DATA which mainly consist of Secondary, Primary, FE and HE institutions who have a vested interest in D&T. A copy was also sent separately by me to all key informants who were involved in the interview.

Resources required

The following resources were required, a microphone, tape recorder, tapes, extension lead, digital camera, research questions, copy of the DATA report, QSR Nvivo 7 and Dragon Speak Easy software. The recording equipment was sourced from the Language Department at the school I work at. The software was purchased.

Pilot Informant Interview

A pilot interview was done with the Head of Design (my place of work) to check the questions for simple interpretation by the interviewee and the amount of time the interview would take to conduct. The results consisted of a number of minor changes to wording of questions. It was also realised that the original questions posed to School A. may change compared to School B. due to the direction that the informant type interviews may take. This was considered to be a natural way of developing the instrument.

The Sample

Non- probability sampling methods were used for both the informant interviews and the questionnaire administration. This is primarily due to cost. A purposive sampling

method (cases are judged as typically of interest to the researcher) was used for identifying the respondents for the informant interviews. The schools were selected based on their variation in academic profiles. It was essential that the D&T departments within the schools varied in their culture and context:-

School A	Has a history as well as currently meeting a high level of examination performance in D&T as well as wining local competitions. Is situated in an economically stable area and has a male Head of Department.
School B	Has Specialist School Status, AST's and is situated in an economically deprived area and achieves below the schools GCSE pass rate and has a male Head of Department.
School C	Has Specialist School Status, AST's and is currently situated in an economically stable area and has some specialisms which exceed the schools GCSE results and some which do not. The department also has a female Head of Department.

All the departments are medium sized with a range of specialists.

Priorities and constraints of the research?

Priority

The priority of this phase of the research was to provide a greater understanding of practitioner's conceptions of excellence within the field of design and technology. This understanding was generated through dialogue with heads of department and teachers within the schools, also by viewing exemplar work.

Constraints

The constraints for this type of research were access to heads of department and teachers and the time available to record the interview. This was overcome by selecting times during the year when students' course/examination work had finished or was nearly finished. February and March were used and proved to be very successful, enabling time for me to visit and conduct interviews.

Schedule

1. School A was interviewed on a Wednesday afternoon during a free period in the month of February.
2. School B was interviewed during half-term in the month of February.
3. School C was interviewed on a Wednesday afternoon continuing after school in the month of February.

Extract from Informant Interviews

Below is a small extract from school A which was recorded on tape and transcribed onto a word document using Dragon Speak Easy Software.

SD: Please state your name?

LMS: ******

S. D. gender?

LMS; male

SD: position within the School?

LMS: Head of Design and Technology

S. D: subject specialism within design and technology?

LMS: Resistant Materials

The information was used to categories participant by gender, status, subject specialism, type of institution. All these categories were added to the questionnaire ensuring that all variation in background was recorded. Below shows answers to questions which participants have provided.

Here is an example of a closed question.

SD: What do you prefer to concentrate on, technical competence or creativity?

LMS: Creativity.

Below provides an example of how LMS from School A describes exemplar work which he provided during the interview. A picture is also taken of the work to accompany the description.

SD: Can you describe the first project you have provided.

LMS: This project is an Air Engine. It is part of our double award GCSE in Design and Technology. It is made completely from soft metals and mild steel. It is a project which is jointly done with a local College. They do a workshop for an afternoon with the year 10 and 11 pupils, and we do a workshop here for an afternoon with them.

The piston is manufactured from a CNC Novaturn Lathe and so of course I got CAD and CAM in it, and hand skills for the base plate and the upright. The pulley is turned, and there is a little grub screw on their so they have used tapping, which are referred to as basic engineering skills and CAD CAM ability. It's really well made and it works. When you plug it into compressed air it rotates at about 3000 rpm. It's brilliant, I love it and I think it's a high-quality product.

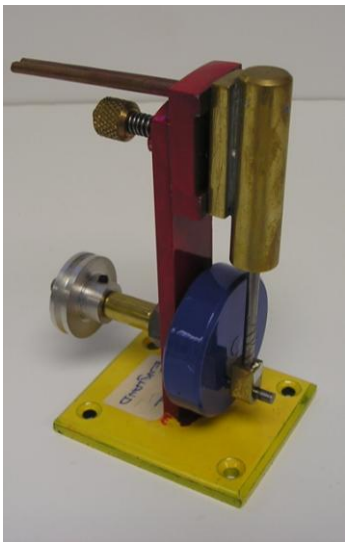

Figure 3.7.1 Picture of Exemplar Work

Summary on the effectiveness of the informant interviews

You can tell by reading the response from the questions and the exemplar material provided that LMS seems more focused on technical competence than creativity. The emphasis on the range of processes within the project was more prominent than what the product did or how it met a need. In fact, upon inspection of the work provided there was little related to any major focus on creativity but lots on improving the technical competence and presentation of work provided. The variation in the types of questions within the informant interview which were presented to practitioners in schools, coupled with the ability to allow teachers to freely talk about the work that

they view as excellent, and what dimension exist within these conceptions, proved to be a rich source of information. This information was entered into QRS NVvivo 7 where a pool of attitude statements were identified and converted into nodes relating to the research questions. These attitude statements were then transferred into a questionnaire.

3.8 Questionnaire Design

Questionnaire design was a critical component of this research project for a number of reasons:-

1. It is the major part of the research approach used to gather quantitative data.
2. Because it was the tool used to gather attitudes on excellence related to students work and had to achieve this without visiting any schools and seeing the work first hand.
3. The only interpretation of the data produced by the questionnaire will be statistical.

Furthermore there is no widely accepted theory on questionnaire design and no attitude survey available on excellence related to practitioners conceptions of students work which are freely available to make use of. With all questionnaires the critical factor is in the material development.

Material development - questionnaire

Personalised response and impersonal response is often related to the way in which you construct your questions, Foddy, W. (1993:82) acknowledges the miscommunication which can occur through the use of language, for example, 'you'

can be used as a personal or generalised pronoun. The respondent can reply in a number of different ways depending on the level of social generality they want to apply. The strength of this approach to questionnaire design is that the words used are provided by practitioners in the field. To avoid any none-substantiated responses and to create interest in filling out the questionnaire I used statements with context to try and generate opinion about specific aspects of excellence, for example:-

No	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.	SD	D	N	A	SA
14	D&T is an interdisciplinary subject made up of many different crafts which all focus on making products/providing services that ***other*** people want/need which contribute to the economic prosperity of the country. With this in mind I spend most of my time focussing on encouraging students to make marketable products for the ***real world*** and avoid making shiny boxes.	1	2	3	4	5

Table 3.8.1 Extract from Questionnaire Statement 14

This question tries to uncover practitioner's conception on whether students should focus on making product for business or products for themselves. Although the statement looks too long it does offer a context to make a judgement upon. Many questions were designed in this way to try to be more thought provoking, to get practitioners to think about the aim of design and technology and why we do things the way we do. For example, is design and technology about promoting economic prosperity or humanity? The informant interview provided lots of statements which correlated within groups of opinions on how practitioners felt about excellence in D&T and what we should be promoting in the individuals within our charge. It was hoped that by contextualising the words that it will offer shared meaning so that resulting statistics from questions will provide a meaningful comparison. A 5-point Likert scale was provided to scale practitioner opinions relating to the statements provided. A neutral option was provided to allow respondents to select in case a question could not be answered due to misunderstanding/neutral opinion or not related to an individuals experience hence it cannot be answered. Only one question

was commented upon by Textiles and Food Technology Teacher's who felt that they could not answer Statement 8, because the statement related more to Product Design, Engineering, Graphics and Resistant Materials Teachers. This was the main draw back from using teacher's attitude statements that sometimes they are too specifically related to their own craft/specialism and need to be slightly reworded to be more inclusive of other specilaisms. This could potentially change the context or meaning of the statement and remove the link from grounded research. It is advised that the breadth of informant interviews should include all variations in specialism if time and resources allow.

The statements produced from the informant interviews were grouped together under the following headings:-

1. General Statements about Design and Technology.
2. The overall aim of Design and Technology.
3. What dimensions are important to promote within D&T?
4. What constitutes excellence in D&T?
5. What hinders excellence in D&T?
6. What is the most effective way of measuring excellence in D&T?
7. What about Centres of Excellence in D&T?
8. Gifted students in D&T.

All these headings were accompanied by a number of statements which were generated directly from what teachers had said during their informant interview. 54 statements were created in total from a pool of 123.

The questionnaire consisted of quantitative data, mainly nominal and ordinal. Nominal data is based on counting variables within a category like gender. This is the lowest level of quantitative data. Ordinal data has a specific order related to a kind of rank. The Likert scale is a common example of ordinal data were 1 is strongly agree and 5 is strongly disagree. 54 statements in the questionnaire used a Likert scale, hence were regarded as ordinal and 17 questions were used to create categories of the participants background. These are referred to as nominal data.

Resources

SPSS (Statistical Package for Social Science) was purchased to complete all statistical computation of the research findings.

Pilot Questionnaire

A pilot questionnaire was given to technology teachers at my School including the Head of Design and Technology. It was also checked by a teacher in the English department to ensure that it was grammatically correct. The pilot questionnaire was corrected using feedback from the respondents. This mainly consisted of a shortening of the statements to provide a reduction in the number of pages (initially 5 single sided pages in length). The introduction and the length of some statements were reduced. The questionnaire was then presented as a double sided A3 page.

The Sample

Non- probability sampling method was used for the questionnaire administration. This is primarily due to time and cost. Probability methods were considered but they were

rejected due to concerns about response rates, time and cost due to the sample being geographically dispersed. The sample consisted of the following variables/categories:-

1. Practitioners from state funded and independent secondary schools.
2. Male and female.
3. NQT(Newly Qualified Teacher), GTP(Graduate Teaching Programme), AST (Advanced Skills Teacher), Excellence Teacher, Head of Department, Inspector within D&T, Consultant within D&T, Recognised Leader within D&T.
4. Moderators and examiners within D&T .
5. Schools with specialist D&T Status.
6. Specialisms – Resistant Materials, Graphics, Textiles, Engineering and Manufacturing, Electronics, Food and Product Design.
7. Practitioners who teach A level D&T.
8. Practitioners with more than 3 years teaching experience.
9. Practitioners with 4 years or more industrial experience .

Priorities and constraints

Priority

Priority of the research was to ensure an accurate, representative measurement of the attitudes and opinions of practitioners within the field of design and technology in Norfolk. Practitioners are categorised in the section ‘sample’.

Constraints

Constraints include:-

1. Level of participation from the technology community, 48 schools available and a sample of 30 to meet.
2. Construction of the questionnaire ensuring it is representative of the opinions of D&T practitioners in Norfolk.
3. Funding £2,000 if required which can be accessed via DATA (DFES funding accessed via DT Excellence Mark in Primary Schools).

3.9 Questionnaire Administration

A comparison of questionnaire communication methods carried out by Fraser, L. and Lawly M. (2000, pg 3) provides a range of administration methods and criteria which must be considered. The criteria were put in an order of importance which suited the researcher, as seen below:-

Criteria	**Mail questionnaire**	**Personally administered**	**Telephone questionnaire**	**Internet questionnaire**
Response rate	Low	High	Moderate	Very low
Question complexity	Simple to moderate	Simple to complex	Simple only	Simple to moderate
Respondent anonymity	Possible	Not possible	Not possible	Possible
Speed of data collection	Slow	Immediate	Immediate	Fast
Interviewer bias	None	High	Medium	None

Table 3.9.1 Comparison of questionnaire communication methods

A major problem faced by researchers is getting people to respond to questionnaires, particularly in some sections of society which are becoming over-surveyed, Fraser, L. and Lawly M. (2000). With this in mind, a return of 30 correctly answered questionnaires was set and seen as realistic, considering only the geographical area of Norfolk was being surveyed, which consists of 48 schools.

The main method of delivery used was personally administered. This method of delivery was selected as being the most realistic. Personally delivered does not mean that the questions were read to the participants and their answers recorded by the administrator. The timing of the questionnaire was crucial to ensure that the work load placed on the target audience did not hinder the opportunity of completing the questionnaires. It was obvious that this was best achieved when practitioners were away from school on professional development.

Initially it was anticipated that approximately 15 completed questionnaires would come from the 3 schools who were involved in the informant interview. This would provide a concentration of data which was only spread over 3 schools and hence a concentration of attitudes particularly if the culture of the organisation had played a major part of shaping the attitudes of the respondents.

The questionnaires were delivered by the researcher to the 3 schools who were involved in the informant interviews. The questionnaires were introduced and distributed amongst staff with an accompanying deadline of a week for completion. This first phase in the schedule provided reassuring feedback. The respondents felt that the questionnaires were suitable and no negative feedback was received.

Feedback was positive and practitioners mentioned that they felt the questions were thought provoking (actual words from School C).

This method of administration yielded the following results:-

School A – 5 questionnaires completed

School B – 4 questionnaires completed

School C – 4 questionnaires completed

A further seventeen were needed, giving the pilot a total of 30 responses. On the 8th June 2007 the questionnaire was emailed to all forty-eight secondary schools in the Norfolk area. The email gave a short introduction to the purpose of the questionnaire and the name and address to return them to. This method yielded the following result:-

1 questionnaire was completed

Leaving a remaining sixteen questionnaires needed. A presentation targeting Design and Technology practitioners in Norfolk was organised at the school were I work on their Annual Industry Day and provided the opportunity to distribute and collect the questionnaire on the same day. This was used to increase access to D&T teachers and allow additional time available to complete the questionnaires. The event was held on the 15th June 2007. Over 90 people attended, of which, twenty-four were local school teachers which comprised of both comprehensive and independent. Six of the twenty-

four had already completed the questionnaires leaving a potential eighteen participants. This method yielded the following result:-

11 questionnaires were completed

This left a remaining five to meet the target of thirty. The presentation received attention from Business Manager Simon Coward* of the Hethel Centre of Excellence in Engineering. I emailed my draft report to him. He was interested in pursuing the need for a centre of excellence in Design, Technology which could be combined with engineering and manufacturing. This led to the opportunity of presenting at another conference on the 10th July 2007 at the Hethel Centre (see Appendices). Thirty-seven teachers attended, nine of these teachers were either maths or science based. Eighteen teachers had already completed the questionnaire leaving a potential ten.
This method yielded the following result:-

5 questionnaires were completed

The results above show clearly that asking teachers to complete questionnaires during a technology event is more effective than emailing them. This may also be true of emailing web-links to web-based questionnaires which was considered for this project and may also be considered as a future method of administration. If the geographical dispersion of the participants had been greater then a web-based questionnaire may have been selected. Software to develop a web-based questionnaire was considered but the cost was substantial. It is hoped that the empirical findings of this report may

initiate funding for a national questionnaire with a sample size of 600 – 1000 justifying the initial cost required for the software and training.

Quality of research - Internal and external validity

Internal validity is related to the relationship between what you are trying to measure and what you are actually measuring. It can be loosely understood as the relationship between the literature review, research questions, the instrumentation which is implemented and the generalisation made. It is concerned with the degree of confidence the researcher has on the casual effects between variables. A lack of internal validity would be related to the informant interview seeking answers to questions which have a loose or weak relationship to the research question. Table 3.10.1 has been implemented to ensure that the research questions at the beginning of the methodology section are completely covered and are related to the informant interview which feeds the questionnaire. The interview questions which feed into the attitude statements for the questionnaire will also reduce the risk of questions being misinterpreted because they are generated directly from experience. What is important is to ensure that the statements are adequately representative of the number of different attitudes within the Norfolk area. In simple terms, that the theoretical scale which you provide via the questionnaire is based on the underling concepts in the literature review, allowing respondents to locate themselves within it. If practitioners feel that their attitude is not represented by the questionnaire then they may refuse to complete them.

Although the interview process has a number of identified flaws (Robson, C. 2005) the use of both interview and questionnaire provided a rich pool of data. The

interviews provided low inference description by using direct quotes from the findings.

External validity is related to other researchers obtaining the same data from the same sample. If the sampling is faulty then the ability to generalise the findings from a specific setting to the more general is lost. The triangulation of research will contribute to offset limitations between instruments. Robinson, C (2005) and steps 1-6 and Fraser, L. and Lawly M. (2000:19-34) steps 1 - 5 have been implemented to ensure that both internal and external validity have been implemented through good interview and questionnaire design practice. The use of piloting has also been used to reduce misinterpretation of questions before the main instruments are used on the sample.

Objectivity

Observer and participant bias was a major focus as a way of minimising bias. It was stressed to participants that exemplar work which is viewed, is not measured against work from any other school or measured against the experience of the observer. It is purely used as representative of the nature of the work which that particular practitioners sees as worthy of recognition. This was communicated to the participant prior to organising the interview and at the beginning of the interview (See appendices). Observer and participant bias was minimised by ensuring that all questionnaires were anonymous. Questionnaires at events were distributed and collected by other members of staff to reduce the effect of relationships between researcher and the respondent.

Ethics

All research was conducted in accordance to Bera (British Educational Research Association) requirements. The questionnaire phase of the research had no direct effect on the learner or the participant completing the questionnaire, no names are used and the data will be self reported. The interview process was organised with due care and consideration for the interviewee. Permission for the use of recording equipment was agreed before the interview. The microphone was positioned so that it was unobtrusive to make interviewees feel comfortable. The interviewee was given the right to refuse to take part in the research and also the right to retract the tape and accompanying manuscript at any point during and immediately after the interview.

The main ethical issues with voluntary consent are as follows:-

1. The time taken to complete the questionnaire. It was conducted during a period considered by practitioners to be less demanding and have less of an impact on work load (just after Christmas) i.e. avoiding exams, start of academic year, coursework deadlines etc.
2. The right to withdraw from the interview or have the questionnaire withdrawn at any time.
3. Giving the reason for completing the questionnaire, how it will be used and whom it will be reported to. This was also explained in the DATA report, when organising and at the beginning of the interview, as well as being communicated during the administration of the questionnaire.

3.10 Methods of DATA Analysis

de Vaus, D. A. (1999), states that there are 3 factors which affect how data is examined which are,

1. The number of variables being examined.
2. The level of measurement of the variables.
3. Whether we want to use our data for descriptive or inferential purposes.

The variables in this research report are based on the background information of the participants which they provide and their conception of excellence in design and technology. de Vaus, D. A. (1999), goes on to say that if we simply want to compare one variable at a time then univariate analysis will be fine, if two then bivariate or three or more requires multivariate analysis. Once this has been decided, the levels of measurement can be applied.

The number of variables in this research report was 81 in total. The level of measurement consisted of ***nominal***, which cannot be ranked only categorised (country of birth, religion, sex), ***ordinal***, where categories can be ranked although the distance between each rank may not be quantifiably equal.

de Vaus, D. A. (1999), states that the variables must be clear and linked directly to the research questions you are asking and whether you want to be descriptive with your research or inferential. Descriptive techniques for data presentation are used for analysing patterns in the responses of participants in the sample while inferential techniques are those associated with ensuring that the sample is representative of the population in general. de Vaus, D. A. (1999), states that descriptive techniques should

be used first to discover the patterns which may exist within a sample. After the discovery, inferential techniques can be used as a test of significance to ensure that the research is representative. This report makes use of descriptive techniques for statistical representation of data.

Research Objectives	Relevant questions for questionnaire	Level of data	Proposed analysis technique using SPSS
What are Design and Technology teacher's conceptions of excellence within the subject of design and technology? In other words, what do teachers want to promote in the individuals within their charge in pursuit of excellence?	Background information. Section 2 Statements 1-13 and 28 -38	Nominal Ordinal	Frequencies Percentages Central tendency Means Standard deviation
What dimensions exist within these conceptions? In other words, are we seeking to promote humanitarian understanding or technical competence?	Section 2 Statements 18 - 27	Ordinal	Frequencies Percentages Central tendency Means Standard deviation
What is the overall aim of design and technology?	Section 2 Statements 14-17	Ordinal	Frequencies Percentages Central tendency Means Standard deviation
What hinders excellence in Design and Technology?	Section 2 Statements 39 - 40	Ordinal	Frequencies Percentages Central tendency Means Standard deviation

What about centres of excellence in D&T – do we want one?	Section 2 Statements 47 -49	Ordinal	Frequencies Percentages Central tendency Means Standard deviation
What is the most effective way of measuring excellence in Design and Technology?	Section 2 Statements 46 -46	Ordinal	Frequencies Percentages Central tendency Means Standard deviation
How do we identify gifted students in Design and Technology?	Section 2 Statements 50 - 54	Ordinal	Frequencies Percentages Central tendency Means Standard deviation

Table 3.10.1 Links between the stages of the research process and data analysis

The coded questions will be edited and then sections will be checked for completeness and uniformity. Coded answers will then be best presented according to their initial function.

The data will be processed using SPSS version 15. The analysis of the data will be processed in the following manner:-

1. Frequency and percentages.
2. Sum.
3. Mean.
4. Mode.
5. Standard Deviation.
6. Kurtosis.
7. Skewness.
8. Cronbach Alpha.

The initial analysis is univariate and descriptive. Descriptive statistics are provided through the use of frequency patterns. Data based on frequency distribution, provides data on the number of participants within data categories. These categories include gender, technology specialism, years of teaching and industrial experience, status and a number of other attributes which can be used to find out the backgrounds of participants and how this might effect how they answered the questionnaire. Data on frequency also provides information on the distribution of participants opinions, for example, who strongly disagreed, disagreed, neutral, agree and strongly agree with the attitude statements. Frequency patterns can also be used to identify the median when accumulative percentage hits 50%.

Calculating the sum will provide an attitude index which correlates to a positive, neutral or negative attitude towards a single or group of statements. For example, a single response using a 5 point Likert scale with 10 statements will provide a potential sum of 50 if the participant strongly agrees with all the statements. A score of 30 would indicate a neutral attitude and a score of 10 would indicate that the participants strongly disagree with the statement. Initially the sum will be used to identify, within clusters of statements, strong positive and negative attitudes towards excellence.

The mean will provide a statistic based the average response as a measure of central tendency to the attitude statements answered. Because the mean can be greatly effected by outliers (data outside the main cluster of responses), the variance must be calculated which represents the spread around the mean. Kurtosis -a measure of the extent to which observations cluster around a central point will also be used. For a

normal distribution, the value of the kurtosis statistic is zero. Positive kurtosis indicates that the participant's opinions cluster more and the distribution curve will have longer tails than those in the normal distribution, and negative kurtosis indicates that the participant's opinions cluster less and the distribution curve will have shorter tails.

The mode is calculated to ensure that the single most common response to any statement can be recognised and also to identify statements with low means scores due to outliers but high mode scores.

Frequency distribution will be plotted using a histogram and normal distribution curve. Skew will be checked to identify if the sample is bias towards strongly agreeing, disagreeing or are neutral about a statement. Skew positive or negative shows bias, a zero skew represents normal distribution. A distribution with a significant positive skew has a long right tail. A distribution with a significant negative skew has a long left tail. As a guideline, a skew value more than twice its standard error is taken to indicate a departure from symmetry. It is also important to note that in a skewed distribution that the mean, mode and median are all different. Box plot graphs will be used to identify outliers for further analysis.

Standard deviation is also calculated as a measure of the dispersion around the mean. This calculation represents the spread of opinion relating to the selection of the attitude statements. Standard Deviation also allows the use of relating the findings to the general population using probability theory. Probability theory states that in a normal distribution that 68% of all cases will lie 1 standard deviation above or below

the mean and 95% of all cases will be 2 standard deviation above or below the mean. Normal distribution will be checked using a histogram with a distribution curve.

4.0 Research Findings and Analysis - Questionnaire

In this chapter I will present my findings and analysis from the questionnaire. The analysis is linked to my research questions, issues raised in the literature review and the impact these may have on the D&T field.

4.1 Research Findings and Analysis - Background of Participants

The literature review reported, 'excellence is reflective of the field, hence it is the field which must discover it' and 'D&T is made up of different crafts with different cultures'. The Survey methodology promoted in this report used a variable by case matrix which was set-up in SPSS, it was important to ensure that the various cultures and crafts within the field of D&T were reflected in the findings. Although a non-probability sampling method was used, a broad sample of the field was obtained.

All Questionnaires were completed by teachers in Norfolk. SPSS (Statistical Package for Social Science) was used to process the data and present the findings. The findings are based on the frequency and percentage of respondent's responses.

The following descriptive statistics provide an overview of the categories which represent the background of respondents:-

(*N*=30 for all tables)

Sex

		Frequency	Percent	Cumulative Percent
Valid	Male	18	60.0	60.0
	Female	12	40.0	100.0
	Total	30	100.0	

Table 4.1.1 Gender

Table 4.1.1 shows that out of a total of 30 respondents, 60% were male and 40% were female. A cross-tabulation based on gender shows that females were not represented in the sample from Independent schools. There were more female NQT's than male in our sample (3 female 1 male). There were more male Heads of Department than female (3 female, 5 male). The only AST was male.

Respondents were asked to identify themselves as consultant or leaders in the field of D&T. A descriptor was provided to describe what a consultant and leader in the field means (see appendices 4). 1 male respondent identified himself as a consultant to the field of D&T he was from the independent sector. Another male identified himself as a leader within the field of D&T (from the state sector).

Respondents were asked to identify their ***main*** specialism. A descriptor was provided in the questionnaire to contextualise what specialism means. Most respondents who specialise in resistant materials are male, 16 male, 3 female. All respondents who specialise in textiles are female. 2 male and 1 female respondents specialise in electronics and 3 male and 2 female respondents specialise in graphics, 2 male and 1 female respondents specialise in Product Design. All teachers who specialise in Food are female and in Engineering are male.

All specialisms currently known to the researcher were covered in the sample.

Note: The following categories are used to understand the culture of the respondents with respect to the institutions they represent.

Independent School

		Frequency	Percent	Cumulative Percent
Valid	No	26	86.7	86.7
	Yes	4	13.3	100.0
	Total	30	100.0	

Table 4.1.2 Type of school - Independent

The above table provides the number of respondents from the independent sector. The school targeted for this research has a reputation for D&T within Norfolk.

State Funded School

		Frequency	Percent	Cumulative Percent
Valid	No	5	16.7	16.7
	Yes	25	83.3	100.0
	Total	30	100.0	

Table 4.1.3 Type of school – State

The above table provides the number of respondents from the state sector. The table shows that a large majority of the respondents are from the state sector. The sample also contains schools from economically deprived and affluent areas based on examination attainment.

FE/HE - Further and Higher Education

		Frequency	Percent	Cumulative Percent
Valid	No	29	96.7	96.7
	Yes	1	3.3	100.0
	Total	30	100.0	

Table 4.1.4 Type of school – FE/HE

Respondents from FE were asked to complete the questionnaire. These participants currently teach KS4 students as a part of the county's technology link programme.

Note: The following set of categories is used to understand the level of experience the sample contains.

NQT - Newly Qualified Teacher

		Frequency	Percent	Cumulative Percent
Valid	No	26	86.7	86.7
	Yes	4	13.3	100.0
	Total	30	100.0	

Table 4.1.5 NQT (Newly Qualified Teacher)

The above table provides data on the number and percentage of respondents who were NQT's. No respondents completing a GTP (Graduate Teacher Programme) were sampled.

AST – Advanced Skills Teacher

		Frequency	Percent	Cumulative Percent
Valid	No	29	96.7	96.7
	Yes	1	3.3	100.0
	Total	30	100.0	

Table 4.1.6 Advanced Skills Teacher

The above table provides data on the number and percentage of respondents who were AST's. No respondents selected the category 'Excellence Teacher' (see questionnaire in appendices). The following descriptor was provided under the heading 'Excellence Teacher'; 'recognised as being an Excellence Teacher and on an Excellence Teacher's pay scale'. It may be that this particular pay initiative does not exist in Norfolk hence the reason why it was not selected by respondents.

Moderator/examiner

		Frequency	Percent	Cumulative Percent
Valid	No	23	76.7	76.7
	Yes	7	23.3	100.0
	Total	30	100.0	

Table 4.1.7 Moderators and examiners

The above table shows that 7 respondents are moderators/examiners for one or more of the specialisms listed.

Head of Department/Faculty

		Frequency	Percent	Cumulative Percent
Valid	No	22	73.3	73.3
	Yes	8	26.7	100.0
	Total	30	100.0	

Table 4.1.8 Head of Department or Head of Faculty

The above table shows that 8 respondents are Heads of Department/Faculty in D&T.

Consultant in the field of D&T

		Frequency	Percent	Cumulative Percent
Valid	No	29	96.7	96.7
	Yes	1	3.3	100.0
	Total	30	100.0	

Table 4.1.9 Consultant within D&T

The above table shows that 1 respondent viewed himself as a consultant to the field of D&T. No respondents selected the category 'Inspector'. The descriptor for consultant may not be detailed enough to define what a consultant for the field of D&T should include. For example, consult locally or nationally? This means that this particular indicator which is used to judge respondents level of experience could be misleading. The individual who selected this category has been teaching his specialism for longer than 3 year's, is a moderator/examiner and also teaches A'Level. He is not Head of Department; the examination results of the department he works within achieve higher results than the school exam results. He is of the opinion that the department is seen by the borough/county as leading edge. One of his colleagues agrees with him and two disagree with him. One of the respondents was his Head of Department.

Two sets of questionnaires were returned containing respondents within the same institution which have different views on whether their department is viewed as leading edge. One school was from State Sector and the other Independent. Both schools are within Norfolk.

Recognised Leader within the field of D&T

		Frequency	Percent	Cumulative Percent
Valid	No	29	96.7	96.7
	Yes	1	3.3	100.0
	Total	30	100.0	

Table 4.1.10 Recognised as a leader in the field of D&T

The above table shows that 1 respondent viewed himself as a recognised leader within the field of D&T. The descriptor used for this category is as follows; 'You have provided something within the field of Design and Technology which has received significant recognition, award or notoriety, perhaps research which has led to significant development within the field'. The respondent is male, works within the state sector, has more than 3 years teaching experience and 4 years industrial experience. He teaches A'Level, within his specialism, which is resistant materials and product design. The department he works within achieves higher examination results than the schools published examination results.

Taught main specialism for more than 3 years

		Frequency	Percent	Cumulative Percent
Valid	No	7	23.3	23.3
	Yes	23	76.7	100.0
	Total	30	100.0	

Table 4.1.11 Respondents and their main specialism

4 or more years in industry

		Frequency	Percent	Cumulative Percent
Valid	No	18	60.0	60.0
	Yes	12	40.0	100.0
	Total	30	100.0	

Table 4.1.12 Teachers who have 4 or more years in industry

This category is related to industrial experience the respondents have, which contribute to their main specialism. The descriptor is as follows: 'it refers to time completing apprenticeships, work within a profession which is strongly related to your subject specialism, e.g. a cabinet maker for 5 years, subject specialism; resistant materials'. 40% of respondents have craft based experience which is strongly related to their specialism. This provides evidence that a large proportion of the respondents in the sample have come from industry. This category provides a good indicator of craft based experience.

I currently teach A' Level D&T at my school

		Frequency	Percent	Cumulative Percent
Valid	No	14	46.7	46.7
	Yes	16	53.3	100.0
	Total	30	100.0	

Table 4.1.13 Teachers who deliver A' Level in D&T

53.3 % of the respondents currently teach A'Level in D&T.

A'Level in D&T is delivered at my school but I don't teach it

		Frequency	Percent	Cumulative Percent
Valid	No	25	83.3	83.3
	Yes	5	16.7	100.0
	Total	30	100.0	

Table 4.1.14 Teachers who don't teach A'Level D&T

Only 5 respondents, which make-up 16.7% don't teach A'Level D&T in their school (delivered by other practitioners within the department). 2 of the respondents are NQT's. 4 of the respondents are specialists in resistant materials which is also the most common specialism selected within the sample. 2 of the respondents work within schools with Technology College Status. 4 of the respondents work in schools with good D&T grades compared to their school results.

The NQT's *may* not be given A'Level work because it is their first year of teaching. It may also be possible that respondents who do not deliver A'Level are not required to teach it due to the popularity of their specialism (enough teachers available within department). The respondents who teach in schools with Technology College Status run a system were D&T is delivered as a core subject hence they may be responsible for KS3/4.

Our School has Specialist Technology College Status

		Frequency	Percent	Cumulative Percent
Valid	No	21	70.0	70.0
	Yes	9	30.0	100.0
	Total	30	100.0	

Table 4.1.15 Schools which have Specialist Technology College Status

30 % of the respondents currently teach in a school with Specialist Technology College Status.

Note: 4.1.16 – 4.1.18 provide an indication of the D&T departments examination results compared to the schools results.

Tech dept. exam results are well above school results and the department is recognised as leading edge in borough/county

		Frequency	Percent	Cumulative Percent
Valid	No	17	56.7	56.7
	Yes	13	43.3	100.0
	Total	30	100.0	

Table 4.1.16 Well above average D&T results compared to school results

Tech dept. exam results are above average compared to school results

		Frequency	Percent	Cumulative Percent
Valid	No	18	60.0	60.0
	Yes	12	40.0	100.0
	Total	30	100.0	

Table 4.1.17 Above average D&T results compared to school results

Tech dept. exam results are below average compared to school results

		Frequency	Percent	Cumulative Percent
Valid	No	25	83.3	83.3
	Yes	5	16.7	100.0
	Total	30	100.0	

Table 4.1.18 Below average D&T results compared to school results

Table 4.1.19 provides data on the spread of specialisms within the sample. These are most of the crafts within the subject of D&T. The chart has been simplified to save space.

Specialists in D&T

Specialists	Frequency	Percent
Resistant Materials	19	63.3
Textiles	5	16.7
Electronic	3	10.0
Graphics	5	16.7
Product Design	3	10.0
Food Tech/Home Economics	3	10.0
Engineering and Manufacturing	2	6.7

Table 4.1.19 Specialists within the sample

Analysis

The statistics based on the background information of respondents, show that most of the categories within the questionnaire were represented to varying degrees. Because a non-probability sample method was selected as a method of selecting respondents, the findings cannot be applied to the general population. The sample does represent many of the crafts and cultures within the field of D&T but are not in the correct proportions.

Initially this information was used collectively to identify the attitude of the whole sample to see if there is consensus on what constitutes excellence in D&T. The findings support the view that there is consensus on many aspects of excellence in D&T and research findings in 4.2 and 4.3 prove this.

Implication of findings

The findings have uncovered a general attitude towards what constitutes excellence in D&T. If the range of specialists all had their own conception of what constitutes excellence in D&T then this would have had an impact on the structure of a centre of excellence. Because there is general consensus it means that a centre of excellence should be accessible based on a common focus.

4.2 Research Findings and Analysis Questionnaire- Research Question 1

We have identified in chapter 4.1 that we have a broad range of crafts and cultures who have contributed to the findings via the questionnaire. I have started this section with the research question 'what are the conceptions of excellence bound in students work, within the subject of Design and Technology, in the geographical area of Norfolk?' and 'What dimensions exist within these conceptions?'.

To answer these questions, descriptive statistics has been applied to the statements using SPSS Version 15. Table 4.2.1 has been provided to assist with the understanding of the headings used for the statistics.

Statistic	Example Measurement
Mean - mean is used as a measure of central tendency	3.3478
Std. Error of Mean - the standard error of the mean is only 0.2 meaning that probability theory states that the population mean (95%) is within the sample mean +- 0.2 x 2 standard deviations hence 1.8 to 4.8 (interval estimation)	.23193
Std. Deviation - probability theory states that in a normal distribution that 68% of all cases will lie 1 standard deviation above or below the mean and 95% of all cases will be 2 standard deviation above or below the mean	1.11227
Variance - dispersion showing how widely spread the cases are	1.237
Skew - positive or negative shows bias, zero is normal distribution A measure of the asymmetry of a distribution. The normal distribution is symmetric and has a skew value of 0. A distribution with a significant positive skew has a long right tail (bias to the left). A distribution with a significant negative skew has a long left tail (bias to the right). As a guideline, a skew value more than twice its standard error is taken to indicate a departure from symmetry	-.556
Kurtosis - a measure of the extent to which observations cluster around a central point. For a normal distribution, the value of the kurtosis statistic is zero. Positive kurtosis indicates that the observations cluster more and have longer tails than those in the normal distribution, and negative kurtosis indicates that the observations cluster less and have shorter tails	.106
Range - the difference between the minimum and maximum	4.00
Minimum – the minimum value selected on the Likert scale	1.00
Maximum - the maximum value selected on the Likert scale	5.00

Table 4.2.1 Statistics based on Statements 28 - 38

Descriptive Statistics Attitude Statements Regarding Conceptualisation of Excellence and Dimensions (*N = 30*)

	Min. Stat	Max Stat	Sum Stat	Mean Statistic	Std. Deviation Statistic	Vari. Stat	Skew Statistic (Std. Err.0.427)	Kurtosis Statistic. (Std. Error .833)
Statement 21	3.00	5.00	126.00	4.2000	.66436	.441	-.242	-.634
Statement 22	3.00	5.00	125.00	4.1667	.46113	.213	.670	1.132
Statement 18	3.00	5.00	121.00	4.0333	.66868	.447	-.037	-.589
Statement 29	3.00	5.00	123.00	4.1000	.54772	.300	.081	.589
Statement 32	2.00	5.00	123.00	4.1000	.84486	.714	-.566	-.386
Statement 36	2.00	5.00	120.00	4.0000	.74278	.552	-1.082	2.237
Statement 33	2.00	5.00	118.00	3.9333	.78492	.616	-.796	.993
Statement 28	2.00	5.00	115.00	3.8333	.64772	.420	-1.465	3.354
Statement 38	2.00	5.00	110.00	3.6667	.88409	.782	-.547	-.220
Statement 34	2.00	5.00	109.00	3.6333	.85029	.723	-.629	-.074
Statement 30	2.00	5.00	106.00	3.5333	.86037	.740	-.284	-.443
Statement 31	1.00	5.00	105.00	3.5000	.93772	.879	-.941	.551
Statement 37	2.00	5.00	104.00	3.4667	.86037	.740	-.064	-.505
Statement 35	2.00	4.00	102.00	3.4000	.72397	.524	-.794	-.605

Table 4.2.2 Statistics based on Statements

Sum scores = 150 all strongly agree, 120 = all agree, 90 = all neutral, 60 = disagree, 30 = strongly disagree

The above Statements have been placed Table 4.2.2, in descending order, based on their mean statistics. In general all the statements in the above table are supported based on a mean statistic of above 3.0, an index score of 90 or above.

Statements 21, 22, 18, 29, 32 and 36 are some of the statements which respondents, within the sample, think are the most important aspects of design and technology and what they want to promote in students.

Statement 21

Creativity in D&T is probably the most important aspect of the subject. Students must be able to creatively design and manufacture products. D&T is about getting the

students to push the boundaries of creativity to create something fresh and unique, something not seen at school or locally before.

Statement 22

Problem solving is where most of our efforts are focussed. The ideal students project is one that has lead the student to constantly apply themselves using problem solving skills in the pursuit of making a product to fulfil a real need.

Statement 18

Design and Technology is one of the few subjects where ***moral, social*** and ***environmental*** dimensions can be investigated within the subject. Hence we must encourage students to make products which are ***recyclable*** and ***improve peoples' way of life***.

Statement 29

D&T is about getting students to think differently about the made world, designing things in a 'fresh' new way, working outside the box.

Statement 32

The ***main focus*** of a Technology teacher is to enthuse, excite, and motivate students about the subject.

Statement 36

Students who display excellence have a natural flair, ability and understanding, they try to push the boundaries, try new things out, they are not afraid to express this either

through words or on paper. They have the ability to pick up something and gel with it, use it, and a willingness to learn new things.

Statement 33

If I have high ability students then I tend to focus on complex problem solving project work, possibly with additional moral, social or environmental dimensions to it.

Statement 41 provide statistics showing that 40% agree, students who are labelled exemplar or excellent, often exceed assessment objectives very early on and are generally measured by their impact on the field of D&T through local, regional and national competitions. 26.7% disagreed with this statement and 26.7 % were unsure.

The statistics show that all specialists agree on what constitutes excellence in D&T. These are reflected in statement 21, 22, 18, 29, 32 and 36. No alternative attitude was found relating to conceptions of excellence in D&T within the 58 statements.

Analysis

Statement 21 and 29 represents conceptions based on students obtaining an alternative understanding of the made world which leads them to designing products in a fresh new way and working outside the box. This conception, which is strongly agreed with by all crafts and cultures, reflects the attitude that teachers want to promote the ability for students to think differently about their environment (made world) which will lead to a greater understanding of its needs. This finding complements research by Kimbell & Perry (2001) ‘creating change in the made world, about understanding the processes of change and becoming capable in the exercise of change making’. What is evident from the research findings is to create change you need to understand the

processes involved in making change. These processes reflect the principles and practices of the domain which are recognised by the field of D&T. This is a taught component, something which is promoted by teachers and manipulated by the students. To become capable of exercising change requires craft knowledge, experience, pedagogical knowledge and resources which are all made available to the student. What we are describing here can be associated with the 'system view approach' as described by Csikszentmihalyi, M. (1996). Excellence is related to the individual's ability to manipulate the principles and practices of the domain and produce outcomes which are viewed by the field as excellent. If the principles and practices of the domain are unclear or confusing, possibly due to knowledge, skill, teaching practice, which all contribute to confidence, then progress towards this end will be hindered. The inability to manipulate the domain contributes to variations in the rate of success students have with product outcomes, in Norfolk. This must be targeted to improve the way we understand and teach design capability and the knowledge and skill required to make products. A great deal can be learned from those in industry, where the principles and practice are applied, and those on the leading edge in education where the principles and practice are taught.

There is a strong emphasis in the statements on originality or 'thinking outside the box'. These are common terms associated with products which creatively meet an identified need in a way which has not been seen by the individual assessing the work (teacher) before. Hence, the teacher is looking for creatively designed products which are different (novel or original) to their normal experience. I call this the norm.

How can we creatively design products for an external need? I believe the answer to this question relates to the problems students engage in. This view is supported by

statement 22. Much time is spent solving problems in D&T but often little time is spent finding challenging and interesting design problems to solve. Many departments use standard design problems like storage system which often end in a predictable range of products like CD-Racks. A superficial problem will not require depth of analysis, persistence on behalf of the individual pursuing it, or any risk. Risky projects often take students down a path of failure before they find success, exploring avenues which have possibly not been explored before (within education). The success of this process provides recognition. The level of recognition is dependent upon the level of creativity. If the product has a small element of creativity then recognition may not go beyond the classroom. If the product is viewed as very creative then it could have an impact within the field, if promoted by the practitioners involved in nurturing it.

This report does not try to understand aspects of D&T like creativity, only report on what values and beliefs practitioners have about excellence as a way of understanding what we want to promote within the students we nurture. Research into creativity does exist. Nicholl, B. and McLellan, R. (2007) report, there is a great deal of importance placed on harnessing creativity as a means of competing internationally. Kimbell, (2000) states that creativity in D&T education is in crisis. Nicholl, B. and McLellan, R. (2007) go on to suggest that the problems reported are related to a lack of design opportunities which are creating issues with generating design ideas. Too many design contexts are only encouraging students to make use of knowledge based on popular culture, which produce stereotypical designs. This is referred to as 'design fixation'. In simple terms these are the products you see which are common to many D&T departments which include Nike ticks and love hearts, the types of design which are very superficial and don't require the depth of thought and understanding which

can be nurtured within the D&T curriculum. Nicholl, B. and McLellan, R. (2007) approaches understanding creativity from a different prospective than me, they are seeking to understand creativity from a cognitive approach hence their report is focused on the thought processes which go into designing a product. This report looks at the products respondents present, and the emphasis they place on them as a means to understanding what they hold as valuable. Both reports have acknowledged that creativity is fundamental for D&T to be successful. Both reports have identified problem seeking and problems solving as being important in releasing creativity and extending the boundaries of students work, as well as the role of the teacher as being crucial to its success.

The norm in Norfolk

The research findings (informant interviews and experience) show that the norm varies a great deal within the schools in Norfolk. Some schools are designing products for business which are measured on their success by the client they are designed for and often the competitions they win, while others are struggling to meet assessment objectives. Departments focussed on designing products for business, often require students to meet externally driven standards, which are often stricter than the assessment criteria, of the students' qualification. Statistics from statement 11 show that 33.3% of respondents find it difficult to find exciting, challenging design problems for students to engage in. Statement 29 was extracted from a practitioner from School B during an informant interview. The qualitative information obtained from this school identified a strong focus on creativity, which was viewed in the problems they attempted to solve and the products which were made. The profile of the school provides a picture of a highly successful D&T department which is well

known locally for D&T and has results above the pass rate of the school and well above the national average. They also focus much of their effort on working with industry hence some of the design problems they engage in are set by industry. The practitioners involved also had a noticeably strong professional efficacy towards D&T practise.

The level of norm is perhaps also linked to statement 40 which shows 50% of the respondents feel that they do not have the resources available to produce work of an exemplar standard. Only 30% of schools in Norfolk feel that they have the resources necessary. 20% are neutral, which may mean that they are unsure of what resources are required to produce exemplar work. In 2002 Ofsted (2002b) found that many secondary schools are having problems in maintaining an up-to-date D&T curriculum. Mostly this relates to ***resource*** and ***INSET*** needs. 30% of the respondents within the quantitative sample in Norfolk still feel that this is the case. A pool of resources is required to provide these schools with the means to develop. Technology centred professional development is required to ensure they can make effective use of such resources.

Respondents within the sample selected the project methodology as the main method of identifying excellence in D&T. Hence all the crafts agree that measuring student outcomes, like products designed and manufactured for the made world, is fundamental in understanding the learning and activity students have undertaken to make the transition from, identified problem to final product. This approach is inline Kimbell, (1997) who states that students autonomously embark on a project, which has an externally driven specification, which will be publicly viewed upon its

completion. Elmer, R (1999) warns of the danger of designing for a externally driven client and the effects this can have on the individuals innovation. This view is not reflected in the research findings. The most creative, innovative projects seen in Norfolk relate to design for an external client, with the peak of success being products designed for industry. Many respondents 80% agree that additional dimensions to excellence are very important. Students should be encouraged to investigate problems which have moral, social and environmental dimensions to them. This is inline with competitions like the Young Engineer for Britain and the Audi Award, where creativity, environmental and social dimensions of excellence is rewarded based on student projects. Seymour (2004) and Chomsky (2003) describe the need for education, for the purpose of humanity, to include these additional dimensions to provide a sustainable future. It is evident that we must find ways of uncovering and nurturing creativity in schools within Norfolk.

The experience I have gained from this research is that many departments in Norfolk need support with setting design problems for students and providing the necessary resources to enable them to be creative in the outcomes they provide. Some departments in Norfolk can provide a creative solution but do not have access to resources to enable this solution to become a reality. Statistics and informant interviews report that some do not have the links and the confidence to approach industry for support.

How do these findings impact on the field?

It is suggested that a centre of excellence should make understanding, developing and nurturing creativity as a means of nurturing excellence in D&T. This would require strong links with the D&T field of research on creativity and a positive response by practitioners in Norfolk. Research on this subject is currently being undertaken and will be published within the next 12 month.

If a centre of excellence is created then a working party should be formed to help locally contextualise how creativity is being nurtured. This perhaps would have previously been the job of the Local Education Advisor in Design and Technology. Most of these advisors no longer exist so few links exist between the school. Often the LEA advisor would provide exemplar work from the county for practitioners to view including providing dialogue of the principles and practice which led to the outcome. The absence of an LEA advisor has had an impact on D&T departments within Norfolk. Some departments are unsure about the quality of the work which students produce compared to the county. Opinions vary within the same institution about the status of the department, as compared to the county, because they have not seen the quality of the work produced locally. These findings complement the view which Ferrari, (2002) holds relating to the need for labelling, as a means of recognising and exercising excellence.

Few forums are created locally and many specialists feel isolated 47%, with only 20% who do not. This view is also supported by Louise, Marks and Kruse, (1996) identifying schools as intellectually and socially isolating places. Being the only specialist in a D&T department means that the only person you can communicate specialist knowledge to is external to the department. Statement 49 provides statistics

showing 80% of practitioners want to network with a centre of excellence as a means of developing the curriculum, 20% are unsure. Rowling, J,R, (2002) and Taylor, C & Ryan C, (2005) supports this view that change is more likely to happen when it is universally wanted, has a vision, direction and is well supported.

Work which is viewed locally as creative should be centralised, enabling practitioners to view the products, technical and educational processes which were used to bring about change. Dissemination of this process will allow the unfolding of what promoted this outcome.

Key points for the conclusion:

1. Create a centre of excellence in D&T with the prime focusing on identifying, understanding and nurturing creativity through strong links with the D&T research community. The links will provide the mechanism to access, respond and contribute to research focussed on developing creativity in D&T.
2. Provide a pool of resources for D&T departments to help raise their standard of norm.
3. Measure the impact of the centre of excellence by entering students work into regional and national competitions in pursuit of identifying a national benchmark.

4.3 Research Findings and Analysis - What is the nature of D&T?

Descriptive Statistics Statements 14, 15, 16, 17

	Min. Statistic	Max. Statistic	Sum Statistic	Mean Statistic	Std. Dev. Statistic	Variance Statistic	Skew Statistic Std. Error 0.427	Kurtosis Statistic. Std. Error 0.833
Statement 17	3.00	5.00	139.00	4.6333	.61495	.378	-1.503	1.332
Statement 14	2.00	5.00	126.00	4.2000	.84690	.717	-.774	-.110
Statement 15	1.00	5.00	97.00	3.2333	1.10433	1.220	.161	-.717
Statement 16	1.00	4.00	75.00	2.5000	1.07479	1.155	-.089	-1.211

Table 4.3.1 Statistics relating to statements 14 -17

Sum scores = 150 all strongly agree, 120 = all agree, 90 = all neutral, 60 = disagree, 30 = strongly disagree

Statements 14 -17 have been placed Table 4.3.1, in descending order, based on their mean statistics. In general all the statements, except statement 16 are supported based on a mean statistic of above 3 and/or sum score of 90 or above. Statement 16 has a mean statistic of 2.5 which means that the average opinion disagrees with the statement. The opinion on this statement is spread (standard deviation, variance and kurtosis values) but the majority of the respondents disagree.

Statement 17

Excellence within a classroom or workshop environment can be seen when all the kids are buzzing and excited about what they are making and proud of their outcomes as opposed to a place where the students and the teacher look like they just don't want to be there.

Statement 14

D&T is an interdisciplinary subject made up of many different crafts which all focus on making products/providing services that ***other*** people want/need which contribute to the economic prosperity of the country. With this in mind I spend most of my time

focussing on encouraging students to make marketable products for the ***real world*** and avoid making shiny boxes.

Statement 15

I spend ***most*** of my time working towards meeting the curriculum requirements, raising examination marks, assisting the school in increasing its pass rate. Often making products like CD-Racks and Shiny boxes allow me to obtain the grades I need, in the time and resources I have available.

Analysis

Statement 17 describes excellence is in action. Respondents strongly agree that the subject is about promoting a hive of activity where students are excited about what they are doing and are enjoying the subject. This statement reflects what practitioner's think excellent activity should look like while students are engaging in different forms of learning and making. It tells us that work must be done to ensure that what ever changes are applied to the curriculum in pursuit of excellence, must be conducive to learning and the well-being of the students. This is often understood through the use of sampling the attitudes of design and technology students. This may need to be included as a method of ensuring that changes to the curriculum have a positive effect on students.

Statement 14 allows us to understand the respondents' views on the nature of D&T. The statement reflects the conception that D&T is 'interdisciplinary' made-up of many crafts with the primary focus on economic prosperity by making product/services which other people want and need. This contributes to our

understanding of the attitudes of practitioners in Norfolk and adds to the overall definition which is emerging. It tells us that the main focus of D&T should be to ensure that students are motivated and focused, in a hive of activity, making product which are viewed as creative, which contribute to the economic prosperity of the country and have social, moral and environmental dimensions to them. This definition supports the main body of research in the field of D&T which is also cited in Chapter 2, of this report.

Statement 15 provides a split attitude based on some respondents agreeing with the need to focus on meeting curriculum requirements while others disagreed with the statement. This statement 15 was also discussed on a number of occasions with different respondents during interviews. The general feedback was that respondents felt that students with low levels of motivation were given simple tasks like making a CD-Rack, Storage device, shiny box to ensure that they achieved a reasonable grade. In simple terms, these projects were seen as easy ways of obtaining GCSE results. It is felt that the opinion is divided because some departments are beyond the need to implement such strategies while others are still attempting to reach their optimum GCSE achievement stats and this is seen as a way of doing it. Harris, M & Wilson, V (2003), state that teachers who direct students towards safe projects are more likely to be less confident in their own ability as a practitioner as opposed to regarding students with less ability.

Statement 15

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	s disagree	1	3.3	3.3	3.3
	disagree	7	23.3	23.3	26.7
	not sure	11	36.7	36.7	63.3
	agree	6	20.0	20.0	83.3
	s agree	5	16.7	16.7	100.0
	Total	30	100.0	100.0	

Table 4.3.2 Frequency table for statement 15

Statement 16

D&T is ***not*** about skills which contribute to the economic prosperity of the UK, it is about providing a base education in a broad range of skills. For example, if a student wants to make a shiny box for Mum then they should be encouraged to do so.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	s disagree	7	23.3	23.3	23.3
	disagree	7	23.3	23.3	46.7
	not sure	10	33.3	33.3	80.0
	agree	6	20.0	20.0	100.0
	Total	30	100.0	100.0	

Table 4.3.3 Frequency table for statement 16

By disagreeing with Statement 16 respondents are supporting the view that D&T is about contributing to the economic prosperity of the UK and not about making simple products which are often directed by the need of the student.

To further clarify whether respondents are interested in linking with industry statements 4, 6, 9 and 10 have been analysed.

Descriptive Statistics Statements 4, 6, 9, 10.

	Statement 4	Statement 6	Statement 9	Statement 10
Mean	4.1333	4.1000	2.6667	3.9000
Std. Error of Mean	.12441	.13855	.17508	.15425
Median	4.0000	4.0000	3.0000	4.0000
Mode	4.00	4.00	3.00	4.00
Std. Deviation	.68145	.75886	.95893	.84486
Variance	.464	.576	.920	.714
Skew	-.170	-.172	.242	-.537
Std. Error of Skew	.427	.427	.427	.427
Kurtosis	-.715	-1.187	.052	.014
Std. Error of Kurtosis	.833	.833	.833	.833
Range	2.00	2.00	4.00	3.00
Minimum	3.00	3.00	1.00	2.00
Maximum	5.00	5.00	5.00	5.00
Sum	124.00	123.00	80.00	117.00

Table 4.3.4 Statistics for Statements 4, 6, 9 and 10

Sum scores = 150 all strongly agree, 120 = all agree, 90 = all neutral, 60 = disagree, 30 = strongly disagree

Statements 4, 6, 9 and 10 are statements which all relate to D&T needing extend learning beyond the classroom by networking with industry. Statement 6 refers to industry having input into setting design problems to encourage high performing students to gain experience within the real world. Statement 9 asks respondents if industry currently has an input into their D&T department. The statistics show that few D&T departments actually link with industry in pursuit of extending learning beyond the classroom. Statistics show that a majority of D&T departments' want to link with industry. The informant interviews found that teachers who had a high level of professional efficacy and high level of confidence about their own ability were frustrated by the constraints of their workplace and looked externally for additional knowledge and resources. Ofsted, (2002b) provide us with some of the benefits of linking with industry, 'much of the outstanding work of students' main designing and making projects is linked to industry or community-based projects and nearly always involve a real client'.

How do these findings impact on the field?

D&T is essentially vocational, its principles and practice are industrially orientated. The crafts represented within its subject, reflect what exists in industry and the skills which are promoted, are targeted towards what employers want. Initiatives in D&T, like CAD/CAM (Computer-Aided Design and Manufacturing) reflect industrial practice. Design software like Solidworks or ProEngineer are used in schools and industry. My own personal experience directed me to make a number of industrial visits to a local company who design and manufacture furniture. I spent some time in their design office learning about good design practice related to the furniture industry. The company uses the same design software as I use in school – Solidworks. It made sense to me that to professional develop your craft specific knowledge, you make links with industry which are involved in that craft. Harris, M and Wilson, V (2003) also arrive at the same conclusion. They request, that more funding is made available to find ways of promoting collaboration between industry and education. The government is currently focussing effort on improving creativity in industry as a method of competing nationally. Centre's focussed on business enterprise exist in many regions of the country. These centres have strong links with local industry and can act as a means of bridging the gap between industry and education.

Key points for the conclusion:

1. A centre of excellence, possibly located in an existing Business Enterprise centre, must objectively report of the benefits and constraints of collaborating with industry to the research community.
2. Local industry must be involved with assisting continuous professional development of teachers (matched against a local training needs analysis).

4.4 Reliability Calculation

Reliability means the degree to which the scores obtained from the questionnaire can be repeated if it was to be administered again under identical conditions. An unreliable scale is the result of unreliable items. Each statement must be tested for its reliability. Because it is not possible to administer the test twice to the same sample an item-to-item correlation is done to check the consistency. This provides the measure of the overall reliability of the scale. The statistic for this measurement is between 0 – 1. The higher the figure the more reliable the scale is, an alpha of 0.7 is generally accepted as reliable. The size of the alpha is affected by the individual statements which make-up the scale. To increase the alpha the unreliable items must be dropped.

Cronbach's alpha is a measure of reliability that is a lower bound for the true reliability of the questionnaire. The computation of Cronbach's alpha is based on the number of items on the questionnaire and the ratio of the average inter-item covariance to the average item variance.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items	N of Items
.797	.814	54

Figure 4.4.1 Cronbach Alpha calculation before reducing the statements

An alpha of 0.797 or 0.8 (rounded-up) is already acceptable for the scales reliability. This is probably due to the fact that the statements were extracted from practitioners. To improve the scale SPSS was used to check item-to-item correlations. Statements 1,

7, 11, 12, 16 have been identified in table 4.5.2 under the heading ‘Cronbach's Alpha if Item Deleted’ as needing to be removed to improve the alpha result.

Extract of Item total correlations – all 54 statements were checked

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Statement 1	190.8000	189.683	-.059	.806
Statement 2	190.0000	185.241	.226	.794
Statement 3	190.1333	184.189	.179	.795
Statement 4	189.9333	185.926	.149	.796
Statement 5	189.8667	184.326	.244	.794
Statement 6	189.9667	185.482	.150	.796
Statement 7	190.7333	187.099	.021	.802

Figure 4.4.2 Extract from Item total correlations

Once these have been removed Cronbach’s Alpha is recalculated. Table 4.5.3 shows a considerable increase in the reliability due to removing 5 statements.

New Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.832	.836	49

Figure 4.4.3 Improved Cronbach Alpha result

5.0 Summary of Conclusions

Strengths and limitations of the study

This thesis presents a survey, sampling some of the conceptions of design and technology practitioners within the geographical area of Norfolk. The strength of this thesis is based in the use of mixed methods for the development of a questionnaire (quantitative instrument) using statements from 3 informant interviews (qualitative instrument).

A reliability measurement of over 0.8 (Cronbach's Alpha) means that a strong link exist between the opinions of the respondents from the informant interviews, and the respondents who completed the questionnaire. Further work can be done on data reduction and conceptual alignment. This is done by factorising the statements. This will get rid of statements which measure the same concept and align statements based on a single factor (statistical relationship). These factors are then checked for conceptual alignment. Further analysis (bivariate and multivariate) of the 81 variables, within the questionnaire can be done to further understand the findings. ***This was not pursued to the restriction in word limit and time.***

Limitations within the findings of this research exist relating to the sample size for both the informant interviews and questionnaire. A greater number and range of specialisms could be represented in the sample for informant interviews. A larger sample size for the questionnaire would also allow for a more accurate generalisation of the findings based of the general population.

A great difficulty exists when requesting practitioners within schools to contribute to educational research. You will never hear a teacher proclaim that they have spare time available unless they can see a great benefit to the professional development of themselves, their staff or the development of their students. This limitation was overcome by requesting practitioners to contribute to this research during events which were focussed on professional development and/or the dissemination of knowledge.

The Core of the Findings

Although D&T teachers entered the profession from a wide range of backgrounds and represent a range of crafts they generally and collectively agree on conceptions of excellence in D&T. These conceptions are very much inline with current research on the nature of D&T as presented by the literature review. The research practise has provided me with the opportunity to compare what teachers within the sample want to promote in students within their remit and compare this with what they are providing by viewing exemplar work. Practitioner's conceptions provide us with a picture which emphasises creativity in the design and manufacturing of products for the made world. This means that practitioners value creativity over technical competence. This does not mean that we should not make products well. It simply means that when viewing the outcome, creativity holds more weight in the opinions and attitudes of those who judge it.

Some departments are successful in nurturing creativity while others are still struggling with meeting the single dimension of technical competence. The core of this problem is based on the need for practitioners to understand how to teach students

to be creative. To be able to understand the principles and practices involved in creativity, which lead to producing an outcome which is recognised either locally and/or nationally through its impact within the field.

It could be that confident, knowledgeable teachers with strong sense of professional efficacy have fostered relationships with industry and embarked on projects with are industrially focussed (real problems) in pursuit of extending their resources beyond the classroom. In doing this, these departments may have exposed these students to some of the principles and practices which exist in industry which have contributed to their success. This observation is certainly validates my own personal experience with a small number of students who have integrated with, and embarked on, designing products for industry. The work produced is of an exceptional standard which was recognised locally through the media, as well as nationally through winning awards. This would also support the modified systems view which focussed on bringing the individual, the domain and the field closer together to nurture excellence. Design and technology is a vocational subject which aligns its self with providing skills which are industry focussed. The pressure on industry to be creative is much greater than that of education. By bringing the field and the domain closer together and fostering relationships with industry, we can provide the means to create work which is viewed by the field as excellent. A centre of excellence focussed on bringing education closer to industry and developing practice, which contributes to promoting creativity, will provide the mechanism to nurture excellence.

Implications of this research

Respondents value creativity through problem finding and problem solving and want this to excite and motivate students in their pursuit to making products for the real world. They see industry playing an intricate part in developing education in Norfolk, by setting design problems, providing resources and supporting education through a web of opportunity, through a single, central, locally accessible centre of excellence. Such a centre must focus on bringing the field, the individual and the domain closer together.

To develop a strong focus on nurturing creativity will require the centre of excellence to link with the research community and industry which will assist in the development of knowledge and the understanding of practice. Such a centre must actively report to the research community on its progress towards developing and implementing deliberate practice (processes involved in promoting creativity). To provide opportunities for students to design and manufacture products which are viewed as creative will require links with industry, local professional development, the creation and access to a knowledge base and a pool of resources. The structure of the this centre should be based on figure 3.2.2.

This report recommends that a local Centre of Excellence should focus on the following bullet points based on the findings from this research report:-

1. Create an independent Centre of excellence within Norfolk accessible to all schools.

2. Bring the student, domain and the field closer by providing closer links based on the modified systems view (figure 3.2).
3. Provide Norfolk schools access to a pool of resources (priority given to under resourced departments).
4. Create a 'Centre for Creativity' with the main focus of creating a visually (exemplar work) recognisable standard of excellence within Norfolk for departments to benchmark against. Create a working party to focus on recognise effective teaching and develop deliberate practice towards nurturing creativity Links with industry and DATA to support and develop design practice.
5. To provide CPD for Norfolk teachers, initially focussed on design and manufacturing and later focussed on a training needs analysis.
6. Act as a central point for all agencies with a vested interest in design, technology, engineering and manufacturing.
7. Centralise information through the creation of a local D&T knowledge base.
8. Local working parties to assist DATA in the development of a Mark of Excellence for D&T departments. This will allow schools who work with the centre of excellence (act as an associate scheme) to work towards or achieve a standard of excellence.

Final Word

This research has focussed much of its efforts in identifying what practitioners hold as valuable, as a means of uncovering what they want to promote within individuals they teach. As stated in the literature review, excellence can be approached by looking at a number of different prospectives, by looking at the person carrying out the work

(students), from the analysis of the products which arise from their efforts (portfolios, products, exams), from the processes in place which bring about the product (institutional resources, structure, culture and practice), or from the response of others to the existence of this product (leaders in the field, judges of competitions).

This research has validated the need to identify and understand creativity in design and technology because it is core to the conceptualisation of practitioners in pursuit of achieving excellence. As Mascolo, M.F. et al. (2002) advises, now we understand what we hold as valued endpoints in D&T we must understand the processes which enable us to achieve this end. We must ensure we focus our efforts in understanding excellence from the prospective of the processes which are in place which bring about the product. Nicholl, B. & McLellan, R. (2007) has made some distance on meeting this need, but until we understand the processes in place, we cannot arrange our resources, develop our knowledge to achieve this outcome. Until this is achieved many departments will continue to wonder blind in pursuit of achieving the highest possible standard achievable in D&T; excellence!

Progress Towards a Centre of Excellence

A draft copy of the research report was given to a local business enterprise centre referred to as Hethel Engineering. In response, officials at the centre; Simon Coward and Derek Hillyard asked me to give a presentation to local D&T teachers on the theme of developing a centre of excellence in Norfolk as described by my research report. It was well attended and well received. Proposals for funding has now been submitted and preliminary agreement by EEDA (East of England Development Agency), LSC (Local Skills Counsel) and NCC (Norfolk County Council) has been

given to set-up a centre of excellence in D&T within the Hethel Centre. Many of the recommendations including a centre of creativity will now be put into practice.

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Appendices

1. DATA Report for Teachers prior to informant interview.
2. Email for Informant Interviews
3. Questionnaire
4. Letter from Hethel Centre

1. DATA Report for teachers prior to informant interview.

2. Email for Informant Interviews

Dear ****,

Thank you kindly in agreeing to participate in the Centre of Excellence/Kite Mark for Design and Technology Project. The aim of the project is to understand practitioner's conceptions of excellence in the field of design and technology. I have attached a copy of a report which will be published in DATA Practice in February for your perusal. The report will act as a good introduction to the debate which the research hopes to provide some mileage towards understanding. If you could provide any physical examples of excellent projects and would allow me to take a picture of them it would be much appreciated. If not just a mental picture of what you think excellence in design and technology should look like!

The discussion on the day will be recorded and later transcribed to enable data analysis to be carried out. Comparisons will be made based on identifying a common linguistic approach (common terms or phases) towards identifying excellence and its dimensions. This will be used to try and understand what we (as a field) hold as valuable within the field of design and technology and what we want to promote in individuals.

The whole process is confidential and the report will refer to your school as school A or B etc. Exemplar work which is viewed is not measured against work from any other school or measured against the experience of the observer. It is purely used as representative of the nature of the work which that particular practitioners sees as worthy of recognition.

I look forward to seeing you at 2:20pm on Wednesday 31st January 2007.

Any questions please do not hesitate to ask.

Steven Daly
Researcher DATA and Cambridge University
Teacher at ***** School

3. Questionnaire

A Questionnaire Measuring Practitioners Conceptions of Excellence in Design and Technology

About this questionnaire

The purpose of this questionnaire is to try to better understand practitioners' conceptions about what the subject, Design and Technology, promotes within its pupils. The research is being carried out as a pilot for DATA (Design and Technology Association) and in fulfilment for a M.Ed. course at Cambridge University. Once the research is complete it will be published in the DATA Journal and Cambridge University Library. If you would like a copy of the final report then please email a request to sdaly@langleyschool.co.uk. Thank you in advance for your participation.

SECTION 1 - Background of Participant Completing Questionnaire. Please tick√

☐**Male or** ☐**Female**

Tick the boxes below which best describe your current professional status and subject specialism.

√	Selection	Descriptors – used to help you understand the questions
	I work in an Independent School	You currently work in a recognised Independent School. An Independent School receives its income from tuition fees which are paid by parents.
	I work in a State Funded School (comprehensive, special, grant maintained)	You currently work in a recognised state funded school. A state funded school receives its funding from the government so parents do not pay tuition fees.
	I am an NQT	It is now your first year as a newly qualified teacher or you are still within your NQT year.
	I am on a recognised GTP	On a recognised graduate teaching programme which is generally delivered in school and linked to a recognised university.
	I am Head of Department/Faculty	You manage the Design and Technology department, your role **may** also include other departments as well.
	My specialist subject is Resistant Materials	Although you may teach other subjects' you mainly teach Resistant Materials, or it is your main specialism and the subject you have the most knowledge and experience of.
	My specialist subject is Textiles	Although you may teach other subject's you mainly teach textiles, or it is your main specialism and the subject you have the most knowledge and experience of.
	My specialist subject is Product Design	Although you may teach other subjects' you mainly teach Product Design, or it is your main specialism and the subject you have the most knowledge and experience of.
	My specialist subject is Food Technology/ Home Economics	Although you may teach other subjects you mainly teach Food Technology/Home Economics, or it is your main specialism and the subject you have the most knowledge and experience of.
	My specialist subject is Engineering and Manufacturing	Although you may teach other subjects' you mainly teach Engineering and Manufacturing, or it is your main specialism and the subject you have the most knowledge and experience of.
	I am an AST within D&T	Advanced skills teacher within a specialism and are carrying out AST duties with accompanying pay scale.
	I am an Excellence Teacher within D&T	Recognised as being an Excellence Teacher and on an Excellence Teacher's pay scale.
	I am an Inspector	School Inspector ***with a background*** of Design and Technology.
	I am a consultant within the field of D&T	Independent consultant within the field of D&T.
	I am a recognised leader within the field of D&T	You have provided something within the field of Design and Technology which has received significant recognition, award or notoriety (perhaps research which has led to significant development within the field).
	I am a Moderator/Examiner	You have moderated exams or coursework directly related to one of the specialisms.
	I currently teach A level D&T at my school	You teach Design and Technology to A level on your own or as a part of a team.
	We are currently delivering A level D&T at my school	You do not teach A level but other team members in your department are currently delivering the course.
	The school I currently work at has Specialist Design and Technology Status	
	I have had 4 years or more industrial experience before I entered the teaching profession	This does not include work experience, it refers to time completing apprenticeships, work within a profession which is strongly related to your subject specialism, e.g. a cabinet maker for 5 years, subject specialism; resistant materials.
	I have taught my main specialism for more than 3 years.	You have taught your main subject specialism at GCSE or A level for more than 3 years.

	My Technology Department performs well above the school results and is recognised as leading edge within the Borough/County	Your D&T department (not school) is recognised by other schools or the government as a department which takes a lead within the subject or within your specialism.
	The Technology Department achieves above average examination results compared to the school results	Your department's A - C GCSE/A level results are above your schools published A-C results.
	The Technology Department achieves below average examination results compared to the school results	Your department's A - C GCSE/A level results are below your schools published A-C results.

SECTION 2 - Attitude Statements.

Please ***circle*** your response using the 5 point scale to indicate your agreement or disagreement with the following statements.

General Statements about Design and Technology

No	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.	SD	D	N	A	SA
1	I believe that if you teach maths you have other maths teachers in your department, but if you are the only D&T specialist in your department then that would be an isolating experience.	1	2	3	4	5
2	I believe that a good way of developing subject specific knowledge and practice is through local networking with other subject specific practitioners within your specialism.	1	2	3	4	5
3	To develop my subject specific knowledge I often network/link with other establishments outside my school, e.g. schools, colleges, universities and industry.	1	2	3	4	5
4	I believe that the very nature of Design and Technology requires you to network with local industry to extend students learning beyond the classroom.	1	2	3	4	5
5	I believe it is important in Design and Technology to encourage students to exceed their own personal goals, even if it means staying after school or during holiday periods.	1	2	3	4	5
6	I believe that local industry should set design problems for my high performing students to work through, it makes the students experience more related to the real world and more transferable to higher education.	1	2	3	4	5
7	I often restrict students on their initial ideas for their coursework based on the physical size of the project.	1	2	3	4	5
8	Students in my department set their own design problems based on their own personal interest, even if this leads them to making a shiny wooden box or interesting package for a product.	1	2	3	4	5
9	Local business *currently* has a large input into our Design and technology departments through links, visits and sponsored student projects.	1	2	3	4	5
10	I believe that the student experience in D&T should mirror industry. This would allow students to gain meaningful work experience instead of sending them to JD Sports.	1	2	3	4	5
11	I believe that it is very difficult to generate exciting and challenging problems for students to undertake for their coursework.	1	2	3	4	5
12	I believe that finding exciting and challenging problems for GCSE/A level students to undertake should be a major focus of a Design and Technology department.	1	2	3	4	5
13	I believe that it is my responsibility to ensure that students pass D&T	1	2	3	4	5

The overall aim of Design and Technology

No	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.	SD	D	N	A	SA
14	D&T is an interdisciplinary subject made up of many different crafts which all focus on making products/providing services that ***other*** people want/need which contribute to the economic prosperity of the country. With this in mind I spend most of my time focussing on encouraging students to make marketable products for the ***real world*** and avoid making shiny boxes.	1	2	3	4	5
15	I spend ***most*** of my time working towards meeting the curriculum requirements, raising examination marks, assisting the school in increasing its pass rate. Often making products like CD-Racks and Shiny boxes allows me to obtain the grades I need, in the time and resources I have available.	1	2	3	4	5
16	D&T is ***not*** about skills which contribute to the economic prosperity of the UK, it is about providing a base education in a broad range of skills. For example, if a student wants to make a shiny box for Mum then they should be encouraged to do so.	1	2	3	4	5
17	Excellence within a classroom or workshop environment can be seen when all the kids are buzzing and excited about what they are making and proud of their outcomes as opposed to a place where the students and the teacher look like they just don't want to be there.	1	2	3	4	5

What dimensions are important to promote within D&T?

No	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.	SD	D	N	A	SA
18	Design and Technology is one of the few subjects where moral, social and environmental dimensions can be investigated within the subject. Hence we must encourage students to make products which are recyclable and improve peoples' way of life.	1	2	3	4	5

19	Students should not design products for themselves, because if they do they try to come to a conclusion too quickly and with little thought. If they design for a business then they have to meet a much higher standard of outcome and ensure that their research is relevant and the product meets the need of the end user.	1	2	3	4	5
20	Technical competence is the most important aspect of D&T. Students must be able to use a number of technical processes.	1	2	3	4	5
21	Creativity in D&T is probably the most important aspect of the subject. Students must be able to creatively design and manufacture products. D&T is about getting the students to push the boundaries of creativity to create something fresh and unique, something not seen at school or locally before.	1	2	3	4	5
22	Problem solving is where most of our efforts are focussed. The ideal students project is one that has lead the student to constantly apply themselves using problem solving skills in the pursuit of making a product to fulfil a real need.	1	2	3	4	5
23	Problem finding is critical, we spend too much time solving superficial problems which amount to very little and often something nobody wants. Technology is about making a small dent in an important problem, something you can really build on.	1	2	3	4	5
24	Innovation and originality are the ultimate outcomes of D&T providing a fresh new way of looking at and solving problems in the real world.	1	2	3	4	5
25	The student's enjoyment of the subject is the most important aspect within D&T ***irrespective*** of what they learn.	1	2	3	4	5
26	The ideal student project is one which has a range of processes in it and makes use of a range of materials, the problem they are trying to solve is not as important.	1	2	3	4	5
27	I think problem solving in D&T is an overused phase, a bit like creativity and innovation they are not properly understood.	1	2	3	4	5

What constitutes excellence in D&T?

No	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.	SD	D	N	A	SA
28	Excellence in Design and Technology is found in the products students produce because it is reflective of their ability, the learning process they have gone through and the resources they have available.	1	2	3	4	5
29	D&T is about getting students to think differently about the made world, designing things in a 'fresh' new way, working outside the box.	1	2	3	4	5
30	Excellence in my job is measured through raising achievement, so all resources are focussed on meeting this.	1	2	3	4	5
31	GCSE grades do not reflect excellence in Design and Technology, especially when some students receive too much help or start their GCSE too early giving them much more time.	1	2	3	4	5
32	The ***main focus*** of a Technology teacher is to enthuse, excite, and motivate students about the subject.	1	2	3	4	5
33	If I have high ability students then I tend to focus on complex problem solving project work possibly with additional moral, social or environmental dimensions to it.	1	2	3	4	5
34	If I have low ability students then I select easy problem based project work, which allows the student to make some mileage towards solving it.	1	2	3	4	5
35	Excellence in D&T is also about disseminating knowledge to others within your local area in a way which is not condescending and promotes positive relationships based on collaboration.	1	2	3	4	5
36	Students who display excellence have a natural flair, ability and understanding, they try to push the boundaries, try new things out, they are not afraid to express this either through words or on paper. They have the ability to pick up something and gel with it, use it, and a willingness to learn new things.	1	2	3	4	5
37	Students who display excellence in D&T have no fear of failure. They are focussed on ideas which require them to take risks, because to take a risk is to accept that you will fail and failure leads to a greater understanding and eventually higher levels of success.	1	2	3	4	5
38	To me a gifted student is somebody who is constantly, ***persistently motivated***, always asking questions. They are working through problems and breaking things down trying to answer questions themselves. They are often their own biggest critic in terms of perfection.	1	2	3	4	5

What hinders excellence in D&T?

No	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.	SD	D	N	A	SA
39	The ability and motivation of the student cohort hinders our progress towards achieving excellence within the subject.	1	2	3	4	5
40	We lack resources at our school so we cannot produce work which could be viewed as exemplar or of an excellent standard.	1	2	3	4	5

What is the most effective way of measuring excellence in D&T?

No	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.	SD	D	N	A	SA
41	The students who I would label as exemplar or excellent often exceed assessment objectives very early on and so they are generally measured by their impact on the field of D&T through local, regional and national competitions.	1	2	3	4	5
42	We should not test the students' ability to deduce the ability of the teacher; we should directly test the teachers' ability as that would be more of an accurate measurement.	1	2	3	4	5
43	Publicity created, for example, students work in magazines and local newspapers is a good way of measuring success.	1	2	3	4	5
44	Examination results are the most effective way of measuring a departments performance.	1	2	3	4	5

45	The most effective way of measuring students' success is by looking at the design problem they have been set and the product they have developed to fulfil the need. This can be easily measured by looking at the students' portfolio of work.	1	2	3	4	5
46	An excellent Design and Technology department is one which is well known locally and nationally through positive public relations.	1	2	3	4	5

What about Centres of Excellence in D&T?

No	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.	SD	D	N	A	SA
47	Recognised regional/borough centres of excellence could assist with local development of the D&T curriculum through collaboration, networking of resources and by assisting schools with phases of development.	1	2	3	4	5
48	A D&T department with a title 'Centre of Excellence' could find themselves isolated due to jealousy from the rest of the Borough.	1	2	3	4	5
49	I would make good use of a department which was recognised as excellent through links and inset.	1	2	3	4	5

Gifted students in D&T.

No	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree.	SD	D	N	A	SA
50	The aim of our school is to deliver a balanced curriculum so we focus on developing the whole child and not a specific ability.	1	2	3	4	5
51	For gifted and talented students within my subject I use a skill, motivation and commitment based measure where I assess the students' practical and mental ability.	1	2	3	4	5
52	I use school based statistics to identify gifted and talented students within my subject like previous and predicted grades.	1	2	3	4	5
53	Once identified our gifted student will be given additional work within our subject to stimulate and develop their ability and performance.	1	2	3	4	5
54	Once identified our gifted student will be fast tracked to a high ability group or go up a year to stimulate and develop their ability.	1	2	3	4	5

4. Letter from Hethel Centre