THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

RESEARCH INVESTIGATION

IS THE ACQUISITION OF TECHNOLOGICAL CAPABILITY UNIFORM IN RURAL AND SUBURBAN CONTEXTS ?

"DADDY, COULD YOU STOP THAT STUFF ON THE COMPUTER, AND COME AND PLAY STAR WARS WITH ME. I WILL BE LUKE SKYWALKER, YOU CAN BE DARTH VADER"

JACK ATKINSON, AGE 6, 1999

1999 KEITH ATKINSON

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"THERE IS A NEED TO CONFRONT A CONTRADICTORY LEGACY IN WHICH CONTEMPT AND AWE ARE MIXED IN ROUGHLY EQUAL MEASURE: TECHNOLOGY IS AN ADMIRABLE SPECIES OF MAGIC, BUT AT THE SAME TIME TECHNOLOGY IS NOT FIT TO BE MENTIONED IN POLITE COMPANY"

BARNETT, M. 1995, PP. 125-126

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I wish to extend my sincere gratitude to the following people:

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Keith Atkinson November 1999

Abstract

This Investigation is the culmination of over three years work as part of a 'taught' Doctorate in Education. The principle aims of the work were to explore and define 'technological capability', and to subsequently ascertain whether context (rural or suburban) affects such a concept. Following a detailed literature review, I chose to explore my emergent conceptualisation of 'Technological Capability' in both rural and suburban comprehensive schools, using 'A' Level Design and Technology as a focus. The views of students and staff were sought, and, after triangulation and analysis, formed a substantive part of my findings, which are acknowledged as being 'developmental' in flavour, lacking any claim to generalizability.

Educational Action Research was the methodology selected, and during the project two research cycles were completed, with suggestions in the conclusive comments about how I might move the project forward in the future. Eclecticism is my chosen way to describe the deployment of a range of research methods used to obtain evidence, an approach that continued into the analysis chapter using a variety of 'clustering' techniques to draw meaning from the questionnaires and taped interviews.

Conclusions and findings from the work include a succinct personal definition of 'technological capability' as it pertains to the subject of 'Design and Technology' in schools in England and Wales, developed from an understanding of various international perspectives on design and technological education. I also found a degree of commonality in the understanding of what constitutes design and technological activity amongst colleagues and pupils that was both refreshing and heartening. The other observation I noted was the importance that context specificity played in the process of learning, it being more important than I had originally thought when writing my 'Research Investigation Proposal (RIP).

The work draws upon the taught elements of the Doctorate in Education, making numerous references to 'taught modules' and making the reader aware that the Investigation must be seen as one part of a three year learning process. To help the reader in trying to comprehend the whole 'journey', a substantive volume of appendices makes reference to summative course reports and other supporting material.

The Investigation has opened up many new avenues of educational issues to explore in the future, and has reinvigorated in me the desire to constantly question and 'do'. It is intended that my notion of defining subject uniqueness in terms of 'unique combinations of command verbs' will lead to a substantive piece of educational research in the future. I have been challenged both by this Investigation and the three year doctoral journey, and feel to have grown as a teacher-researcher, having risen to the challenge that both offered.

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CHAPTER 1

INTRODUCTION

"TOMORROW BELONGS TO THOSE WHO EFFECTIVELY AND CREATIVELY INTERACT WITH TECHNOLOGY TODAY AND DREAM OF POSSIBILITIES FOR TOMORROW"

MADISON COUNTY PUBLIC SCHOOLS, 1998

1999 KEITH ATKINSON

1.0 Introduction

1.0.1 This 'Research Investigation' is a single part of a complex whole. The Doctorate in Education is an 'holistic journey' for course participants. The taught modules, 'Ways of Seeing', 'Research Methods in a Dynamic Context' and 'Management of Change' are interleaved with three 'Coherence & Integration' reports and the current professional practice of the concerned individual, to provide a backdrop against which this work has, and continues to be, developed.

1.0.2 This is not a Ph.D. thesis, and is very much 'work in progress', as required by the course regulations for Ed.D. at The Nottingham Trent University. It is an opening up of an area that is of personal interest to myself as a 'reflective practitioner' ~ see Schon (1987), within a secondary school. It makes no traditional 'claim to knowledge', but more importantly as an 'Action Research' student ~ see Zuber-Skerritt (1992), it highlights improved professional practice as its *raison d'etre*.

1.0.3 This Aims of this Chapter are:

- To guide the reader through the structure of the work.
- To clarify how this work fits within the overall structure of the Ed. D..
- To provide a brief resumé of my own educational journey to date, as relevant to providing a context for this research project.
- To make explicit the specific aims of the work.
- To clarify the parameters and constraints, external and self imposed, that pertain to the work.
- To provide an insight into my research methodology. (Partly replacing a 'traditional' chapter on Methodology in a Ph.D.)
- To give an overview of the what, when, why and how of data gathering, and subsequent analysis. (Research method(s)).

- To provide a sharp definition of the original research question, and those which were generated subsequently.
- To explore the values and ethics relevant to this particular study.

1.1 The Doc 'n' Me

1.1.1 As a mathematician by inclination, the more my headteacher tried to persuade me to read mathematics at university the more I strengthened my resolve to study technology, specifically electronics. My fascination with technology, as opposed to science, began when I was watching a programme on Egypt as a child at primary school. I remember the statistics vividly: 'the Great Pyramid at Giza is made up of 2.2 million blocks, each weighing 2 tons'. How, I thought to myself, could they have achieved this without science (as we in 'The West' define it)? Even more tantalisingly, How is it that we cannot confidently work out how it was done, now that we can place a human being on the moon and get them safely home again?

1.1.2 Collecting knowledge for its own sake is something that has rarely appealed to me. Using knowledge to make things happen or to build links is something that I have always enjoyed. I was intrigued by one sentence in the Ed.D. course details:

> 'It is concerned not with generating new knowledge, but with developing the capability of the practitioner.'
> (TNTU, 1996)

1.1.3 Engaging with qualitative research, placing myself at the centre of the process as an Action Research student, reflecting on my findings and how it influences my professional practice has been a central feature of the course and is personally a most unexpected outcome of the Doctorate. I was a committed mathematical, quantitative logical positivist prior to the course. It is with a degree of intrigue I find myself engaging with and operating from within the interpretative tradition. The boundaries between the two appear to myself to be far hazier than when my journey started.

1.2 The Sleep of Reason

1.2.1 As a Technology teacher, I have had the privilege of working in four schools over fifteen years. During this time I have seen a transformation of my subject from 'Handicraft' via CDT (Craft, Design and Technology) into 'Design and Technology'. From 1993 onwards it is my personal experience that the parents with whom I have had contact, appear to have a growing respect for the subject; its 'currency' as a GCSE appears to have risen significantly in recent years.

1.2.2 The transformation of the subject has been far from smooth ~ see for example: Smithers & Robinson (1992), Thomas-Wright (1993), Conway (1994), Hansen & Froelich (1994), Layton (1995), Paechter (1995), Gradwell (1996) and Lewis (1996), for detailed accounts. Undeniably a major influence in the raising of the profile of Design and Technology, has been the 'National Curriculum' in England and Wales. As a practitioner I have lived through its birth and subsequent revisions, observing with care its evolution into the 'Dearing' version, see NCC (1993) and SCAA (1995), that is currently in use.

1.2.3 I perceive a tangible parallel between what has happened in my specialist subject over the last five years, and my own continuing professional development during the same period. I undertook an M.A. in Technology Education from 1993-1995, looking in detail at 'values in the purposes, processes and products of technology education'. This appeared to be a diminished area of technology education ~ see Conway (Op. Cit.) , Conway and Riggs (1992) and Layton (1992), following the rewriting of the National Curriculum Orders in 1993. For myself the detailed consideration of values remains at the heart of quality technology education.

1.2.4 Having been at the 'sharp end' of constant change for over a decade, spending time re-engaging with fundamental issues relating to design and technological practice in an academic environment somewhat rekindled my reflective consideration of the philosophy, as perceived by myself, of technological education. Continuing this fundamental reflective analysis of myself as educator, I enrolled on the doctoral programme.

1.2.5 C. P. Snow wrote in 1968 that 'The sleep of reason produces monsters', a feeling that captures my motivation for undertaking this investigation. I have had the monster within myself awoken and find it difficult to passively accept or fail to question the diet that is offered up to children and students, whether via the QCA, Ofsted or examination bodies. The word 'capability' appears in many documents and syllabuses pertaining to technology. When deconstructing such documentation - see, for example, Codd (1988), I am often unclear as to the intended meaning of the word.

1.3 The Aims of this Investigation

1.3.1 My original idea was to explore the notion of 'technological capability' within two differing contexts and to compare and contrast the resulting data. This is still the main focus of my research but there are several related themes that have emerged since I produced my 'Research Proposal' in February 1998. I am personally sensitive to geographic contexts ~ see 2.2.25, as I was born in an urban environment, educated in a rural setting and teach within the suburbs of a large city in England.

1.3.2 Implicit in my main research question is an acknowledgement that there are ontological questions concerning the nature and definition of technology itself, as it relates to different cultures. Also, 'Does the notion of technology equate to truth?', and 'What exactly does it mean to be capable?' The very word technology has itself brought a lot of baggage with it into the educational world in recent years. From an epistemological perspective the investigation needed to address issues such as 'What is, and why have, technology education'?, Can one syllabus bridge rural and suburban needs? Trying to address the notion of rural and suburban needs as they relate to technological capability was thought to be beyond the scope of this study. It was felt that 'societal needs' was a big sociological issue that could provide for a lifetime of study. As such, the focus of assessing whether the acquisition of technological capability was uniform within rural and suburban contexts, was thought to be of a sufficiently tight focus and therefore realistic and achievable.

THE IMPACT OF THE TAUGHT ELEMENTS ON THIS INVESTIGATION

1.3.3 Acknowledging the philosophy underpinning the Ed.D. programme, my research was, and still is developmental, rooted in professional practice. Due to the truncated timescale and length of presentation (30-35,000 words minimum), this Investigation has some elements in common with a 'traditional' Ph.D. thesis, as well as many differences. There are sections on aims, methodology and conclusions; the literature review is an integral part of the emergent discernible themes: capability, thinking, learning & teaching, progression and the D&T curriculum and managing change.

1.3.4 My work on both research method and methodology has been constrained by the time scale. This has necessitated reliance on a core of texts that I have come to call 'the famous five' (Cohen & Manion (1980), Bell (1993), Robson (1993), Yin (1994) and Ely et al (1991, 1997)). These texts, along with the taught module on 'Research Methods in a Dynamic Context' have greatly enhanced my skills, perceptions and reflections as a practitioner-researcher.

1.3.5 Four 'themes' evolved as a result of, and in addition to, my original research question. I have engaged with over three hundred articles connected with my research theme, and have immersed myself fully in the minutiae of this one issue. The original question still remains central to the 'Investigation'. The breadth of knowledge I now possess on this topic coupled with my desire to articulate a cogent and coherent philosophy regarding technological capability and contextuality, are the reasons that I do not want my 'reason to sleep' in an attempt to approach satiation of my curiosity vis-à-vis 'technological capability'. I ordered my often tangential imagination into conceptualising this Investigation in terms of five central questions or themes.

MY FIVE CENTRAL QUESTIONS

1.3.6 The 'big' question does not concern the place of D&T in the school curriculum. The National Curriculum has established D&T as a subject for all pupils, regardless of ability, gender, race or geographic location within England and Wales. Exploration of this would not be relevant to this study.

<u>Question 1</u>

Is the acquisition of technological capability uniform within rural and suburban contexts?

1.3.7 The first of the 'spin-off' 'themes' concerns an analysis of what the word 'capability', and specifically 'technological capability' means or implies. Is it simply a modern equivalent of the learning by doing philosophy that underpinned the Sloyd and Handicraft movements ~ see: Penfold (1987), DES - Newsom Report (1963), Kimbell (1994a, p.67) and Eggleston (1993), or is it more subtle and complex?

<u>Question 2</u>

What is meant or implied by the phrase 'technological capability'?

1.3.8 Appearing to be a nose to the grind stone automaton, I had genuinely lost sight of the debate surrounding the interplay between teaching, learning and thinking. Being used to studying syllabuses and a plethora of Government documentation, I was unaware of ontological perspectives *vis-a-vis* education. The epistemology of technology was also something that remained beyond my comprehension, prior to my re-engagement with degree work at a higher level in 1994. The work of Bruner (1966,1969,1987,1996), amongst others, on how children think and the spiral curriculum has been explored and the notion of the school curriculum and how it might relate to student acquisition of technological capability has also formed part of my theoretical work. This perceived gap in my knowledge and practice gave rise to my second emergent theme:

<u>Question 3</u>

Have I as a practitioner a clear understanding of the interplay between teaching, learning and thinking, as it relates to this investigation?

1.3.9 The third of my discernible themes relates directly to the taught modules of the doctorate, my own professional context and my future career aspirations. Over a five year period I have developed a notion that there are similarities between what my understanding of 'why' I teach design and technology and the skills that appear to me to be relevant to senior management in secondary schools. The Ed.D. has heightened this feeling, as has my recent experience in helping to manage a suburban secondary school during the long term absence of two senior colleagues, one being the headteacher. My penultimate question is:

<u>Question 4</u>

What does the doctoral journey offer myself as head of a subject that has undergone significant change, in secondary schools, over the last decade?

1.3.10 The final question is rather less philosophical and more pragmatic, concerning the seemingly age old enemy of education, time. My work on post-modernism ~ see: Hlynka and Yeaman (1993), Appignanesi & Garratt (1995), Plant and Firth (1998), and the notion of the compression of time appear to have manifest itself in my project, given my earlier discussion of the tight time line that the Ed.D. structure imposes on this investigation ~ see 1.3.2 and 1.3.3. My final question, arising out of a feeling of often unbridled anxiety is:

<u>Question 5</u>

Given the time constraints and nature of Ed.D. as contrasted with Ph.D., Which methods of research will be honest, appropriate and attainable?

1.4 The Process of Research

1.4.1 Question 5 (1.3.10) indicates that the work will be developmental in approach (see also 1.0.2). It will also build upon the taught modules of the Ed.D ~ see 1.01.

1.4.2 As I approach the end of the taught elements of the Doctorate I am slowly beginning to be aware that I have, by the very nature of endeavouring to engage with the course with integrity and vigour I have become an 'action researcher'. A declaration that:

> 'The Doctorate is concerned with the personal development of professional practitioners........... pathway members will be involved in practice, will exercise a form of leadership and that the experience of the Doctorate will interleave with professional practice'
> (TNTU, 1996).

appears to provide a basis of vindication for this feeling.

1.4.3 As a teacher with fifteen years experience of 'A' level teaching experience, I felt that a potentially beneficial and natural focus for the enquiry was the 'post 16' phase of secondary education where all students will have undertaken some form of explicit technological education at GCSE level by following the requirements of the National Curriculum in England and Wales for the 1996-98 cohort of Year 11 students. (This cohort being the first or second to undertake the 'Dearing' syllabuses, whose introduction *supposedly* heralded a more uniform range of technological syllabuses as well as a proposed moratorium on syllabus change through to the year 2000. A change of Government, with a subsequent introduction of 'literacy' and 'numeracy' initiatives in primary schools has proven this not to be the case.)

1.4.4 Group discussions have always proven to be of benefit to myself, as subject manager, when assessing how my department appeared to be challenging pupils in the teaching of design and technology. I enjoy interviewing children and discussing issues in small groups. I relished my visits to the two schools in the North and East Midlands areas, this one felt to be representative of a fair cross section of the British educational system. This involved both a 'rural' and 'suburban' school.

1.4.5 Vignettes were a new concept to me at the start of the course. Initially I viewed them as fairly accurate and meaningful thumbnail sketches. Later readings ~ see Salloum (1996) and Bowen (1999a), indicated to me how useful such an approach can be, particularly when combined with other research methods.

1.4.6 There was the possibility of the generation of some statistical analysis, for example, out of a survey of students and teaching staff. It was not felt necessary to provide a detailed commentary, given my chosen paradigm for this Investigation. It could be used, in subsequent follow up work, for the purpose of giving greater clarity to the field interviews that were conducted in the small sample of schools, rather than trying to create a legitimacy through the use of statistics. During the Ed.D. course my investigations into research methods blurred the boundaries (or sharp divisions) that I used to perceive between the qualitative and quantitative traditions.

1.4.7 Due to the nature of the research question, involving human beings and questions of capability within different social contexts, the investigation tends towards the qualitative tradition of research. However, work done on both research 'traditions' (qualitative and quantitative) during the 'Research Methods in a Dynamic Context' module was reflected upon, and analysed in some detail, before this decision was finalised. The sessions of the taught course led by Professor Griffiths during November/December 1997 and again in February/March 1998 were important influences on my choice of methodology.

1.4.8 During the Ed.D. course my investigations into research methods have led me to a more eclectic approach, perceiving less polarity between the qualitative and quantitative traditions. The research methods texts, my 'famous five' mentioned in 1.3.4, have also contributed to my wider appreciation and understanding of methodology, including my approach in this investigation. An analysis of the 'two traditions' (Aristotelian and Gallilean) during May 1997 - see Von Wright (1971), was engaging, thought provoking and challenging.

1.4.9 An experimental or quasi-experimental approach, rooted firmly within the positivist or quantitative paradigm, was also debated with Professor Hastings during May/June 1997. We looked at time scales, and subsequent reading - see: Cohen & Manion (1980, pp. 164-183), Robson (Op.Cit., pp.87-114) and Bell (Op.Cit., pp.11-12), caused me to deem this approach impractical within the available timescale.

1.4.10 An article on 'Second-hand ethnography' by Porter (1994) reinforced with group discussions led by Professor Griffiths in November 1997 developed my understanding and eagerness for this type of study. My background reading - see Cohen & Manion (1980, p.275), again reluctantly drew me to the conclusion that, again, timescale was a bar to this as a viable instrument for this particular investigation.

1.4.11 'Historical Research' methodology was something I looked at carefully, if only for the apparent paradox, with which I have developed an interest, in looking at 'capability' in such a 'new' school subject, the National Curriculum subject that has evolved into 'Design and Technology'. A confirmatory read of Cohen & Manion (1980, pp. 58-64), confirmed the need for the subject to bed itself in to the curriculum before such an approach might be deemed to be fruitful.

1.4.12 As a technologist, with a desire to 'use knowledge' (my own succinct definition of technology being 'technology means making things work, *work* better') I was drawn to Grounded Theory ~ see Henwood and Pidgeon (1995), as a practical and accessible model. Both Glaser and Strauss (1967) and Hendley & Lyle (1995) develop the notion of grounding theory in experience through a local context. Such an approach is particularly relevant to this investigation and appealing to my perception of myself as one of Bronowski's 'Homo Faber' ~ see Cosgrove & Schaverien (1994, p.1). I was also drawn to this *modus operandi* as it involved:

> 'specific analytic strategies formulated for handling, and making sense of, initially ill-structured qualitative data'
> Henwood & Pidgeon (Op. Cit., p.116).

My subsequent rejection of grounded theory, for this investigation, lies in the apparent need to explore: "the participants' own tacit and declared understanding' (Ibid., p.117). Without regular and prolonged contact with the two schools involved I would have difficulty legitimising such an approach. The same drawbacks apply to the use of Kelly's 'Personal Construct Theory' as detailed in Hansen (1995, p.45), another constructivist theory that I found interesting, but less relevant to my investigation.

1.4.13 Cohen & Manion (1980, p.106) note that the purpose of case study is:

> 'to analyse intensively the multifarious phenomena that constitute the life cycle of the unit with a view to establishing generalizations about the wider population to which that unit belongs'.

I have already stated that this Investigation will make no claim to extrapolation or generalizability ~ see 1.0.2. I was therefore going to reject this approach. However, Yin (Op. Cit., pp.127-141) presents a useful way of writing up research that I made use of ~ see 1.4.21. The commonality between case study research and use of vignettes allowed me to use a quasi case study approach in a meaningful and coherent way, with specific regard to the copying up of research findings.

1.4.14 Yin (Ibid., p.6) illustrates, in tabular form, the common focuses that case study shares with survey. They both hone in on contemporary events, yet neither require control over behavioural events. As I am interpreting vignette as a type of 'mini case study' for the purposes of this research, I intend to incorporate a questionnaire and survey within an action research paradigm, to provide two useful vignettes from which to generate the potential for further study in a greater depth, at a later date.

1.4.15 Armed with the instruments indicated in 1.4.13 I have chosen Action Research as my model for researching. Bell (Op. Cit., p.7) crystallises the thinking behind my choice stating that the:

> 'essentially practical, problem-solving nature of action research makes this approach attractive to practitioner-researchers who have identified a problem during the course

> of their work, see the merit in investigating it and, if possible, of improving practice.'

For a further and deeper discussion of my choice of Action Research paradigm see section 4.2.

1.4.16 I am primarily a reflective practitioner, my renewed interest radiating from participation on the Ed.D. course. Bell's description of action research provides a close match to the current perception of myself as teacher-researcher and indeed the research question I chose to answer.

1.4.17 My final illumination regarding chosen method of researching is that no one method appears to fit my project exactly. In debating the overall research process with Professor Griffiths in December 1997 it was posited that research is 'messy and lumpy'. So it has proven when choosing how I should 'get at' the knowledge and information. The journey has however been informative, and a genuine adventure for myself, given that I am an Alpine mountaineer.

1.4.18 As I have immersed myself in the doctorate over the last three years, I have let it wash over me as I have continued my daily practice in school. I can feel a tangible difference, a feeling of improvement in my being (This may be impossible to quantify, but I can qualify and articulate it). This is regardless of any research undertaken or conclusions drawn. I am different to when I started. I find myself in meetings constantly questioning the why when and how of peoples actions. I seek out the thoughts and perspectives of others to try and ascertain their perceptions and beliefs. This I would seldom do prior to engaging with the doctoral programme. In this sense I feel a more competent practitioner, a perspective aided by the research journey, of which this investigation is a part. This is discussed in detail in Chapter 6 ~ see section 6.1.

1.4.19 After defining clearly the terms 'rural' and 'suburban', two schools were selected, one from each category. These schools were culled from lists of personal contacts within the profession. The chosen schools are located within two hour's travelling time of the school in which I work. (One of my responsibilities is to construct the timetable within the institution I work within, in the academic year 1998-1999 I managed to block almost one day free per week to allow for interviews to take place)

1.4.20 VI form students and teachers of 'A' Level Design & Technology syllabuses made up the sample for research. Typical sizes of groups were 4-10 students and 1-2 staff. Each student and teacher was invited to fill out a survey, dispatched to the school in advance of my visit. Out of the group four students were selected to interview, using a set pattern of pre-defined numbers. Students were interviewed in a small group discussion. Although recorded, discussions, were not transcribed. Prompt sheets were used on which notes and observations were recorded ~ see Appendix 4.3 and 5.6.

1.4.21 To legitimise the mixture of methods that I undertook it was felt important to triangulate the data by contacting the two schools after the analysis had been undertaken, to ensure, as far as was possible, the accuracy and legitimacy of findings. It was fully my intention to involve both the staff and student participants in this process. My perceptions and insights on triangulation of data have been shaped by a number of texts - see: Bell (Op. Cit., p.64), Yin (Op. Cit., pp.91-3) and Cohen and Manion, (1980, p.236). Robson, Op. Cit., p.383, postulates that:

> "triangulation in its various guises is an indispensable tool in real world enquiry. It is particularly valuable in the analysis of qualitative data where the trustworthiness of the data is always a worry... It improves the quality of data and in consequence the accuracy of the findings. An alertness for possible triangulation opportunities is a valuable quality in the enquirer.'

1.4.22 Due to the nature of my research question and chosen research methods I elected to use a combination of linear analytic structure intercut with a comparative structure when writing up the report. The value of such an approach is illustrated by Yin (Op. Cit., p.138), who illustrates that both structures can be used for exploratory, explanatory and descriptive purposes. As a design and technology educator I feel these three styles interleave well with my practice. Explored in greater detail in Chapter 4, I feel that the eclecticism with which I have developed my methodology has enabled me to demonstrate both my competence in grasping key concepts of qualitative methods and also my confidence in deploying such methods in a 'real world' setting.

1.5 Ethical Issues

1.5.1 Consent had been obtained at three levels in each of the participating schools. Firstly via the subject teacher. This was due to the informal network of subject specialist colleagues that I have built up during fifteen years of professional practice. Once this link was established the permission was sought of the headteacher via my colleagues in the schools concerned, followed by a formal letter agreeing the parameters of the study. Finally student participation was on a voluntary basis. This proved not to be a problem and all participants were eager to contribute to the ever growing body of serious research into the field of technology education.

1.5.2 Debriefing sessions were set up for two reasons. Firstly as an acknowledgement that if one participates in an activity, one has a right to see the results of such participation. Of equal importance is the second reason, namely for the verification, and therefore triangulation of data ~ see 1.4.20.

1.5.3 Confidentially was of central concern in an age where league tables and comparisons are made between different schools. All head teachers agreed to participate only if anonymity could be guaranteed and they had access to the results prior to the publication of any findings. I adopted the practice of calling the schools by pseudonyms and checking with participating colleagues to see if there were any discernible clues in the text. Any such ambiguities were removed.

1.5.4 Withdrawal from participation was an option for all colleagues, head teachers and students. This was a clear commitment that was made explicit at the outset of the work in all four schools. This commitment was outlined in the rubric of the research instrument (questionnaire), at the start of the taped interviews and also in the initial correspondence with participating schools. All of these details are available in my archive, not appearing in the appendices for reasons of anonymity. As mentioned in Chapter 5 ~ see 5.3.12, nobody subsequently withdrew during either of the research cycles.

1.6 Conclusive Remarks

1.6.1 The main beneficiary of this research is myself as teacher-practitioner. The nature of the Ed.D. makes this a clear objective of the course. There are, however, other spin-offs which may have wider implications.

1.6.2 I hope to publish my findings in technological journals, clearly with the view to stimulating further work in this area. In doing so it is hoped that my work may reach a wider professional audience.

1.6.3 I also hope to be able to lead colleagues within the school in which I work in a more thoughtful and thought provoking manner. It is hoped that this in turn may be beneficial to the students whom attend our school. Whether or not my work will lead to greater technological capability, is questionable. What I can comment on is the certainty with which I feel a more reflective practitioner as a result of the long doctoral journey.

1.7.0 Reflective Remarks

1.7.1 This is personal work, and has the self at the heart of the research process.

1.7.2 The emergent questions were central to my practice as an educator.

- My original question about technological capability caused me to explore why I had been teaching D&T for fifteen years and provided subsequent clarity and clarification.
- My work on teaching learning and thinking made connections with past knowledge, and invoked new personal insights
- The questions were deliberately interwoven with the doctoral journey
- Time constraints and appropriate methodologies appeared to grind and bump against each other frequently

1.7.3 I felt that writing up the research, with hindsight, that this project used Action Research to benefit and effect.

1.7.4 This Investigation cannot, and should not, be viewed in isolation from the Ed.D. course, it is part of a complex whole.

1.7.5 This chapter caused me to synthesise and rationalise my work on method and methodology, and in doing so broadened out my understanding of these issues.

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

CHAPTER 2

CONTEXTUAL ISSUES

"KNOWLEDGE WILL FOREVER GOVERN IGNORANCE. AND A PEOPLE WHO MEAN TO BE THEIR OWN GOVERNORS MUST ARM THEMSELVES WITH THE POWER KNOWLEDGE GIVES"

JAMES MADISON, 1822

1999 KEITH ATKINSON

2.0 Contextual Issues

2.0.1 Chapter 1 identified a number of key issues relevant to myself as a design and technology educator ~ see 1.3.6 to 1.3.10. As a teacher-researcher (very specifically in that order) context specificity is important when dealing with each child as a unique individual in my everyday practice. Acknowledging the centrality of importance of context sensitivity within education, Chapter 2 is concerned with contextualising key issues of this study.

2.0.2 Regarding the notion of 'change' and the management of change, during the course of this project I discerned a parallel between the historic development of design and technology education and my own personal growth through design and technology, as an educator. During the three years of the taught doctorate course I re-engaged with the concepts of teaching, learning and thinking. I have included an analysis of these fundamentals, as they specifically pertain to technological capability.

2.0.3 This chapter lies at the heart of my 'doctoral journey', and as such has been the most difficult to articulate on paper. The journey has been largely proactive, with peaks and troughs, blind alleys and personally unique philosophical moments. The impact the 'taught modules' have had on my practice, and as a unique individual I feel to have been profound. It is my hope that this comes across in not only *what* I articulate, but the *style* in which I convey it. My comprehension of the importance of context, and in particular context specificity, as a result of the dynamic cognitive interplay I have engaged in to bind together all elements of the taught doctorate, leads me to view context as central to an individual's unique development.

2.0.4 At the end of the research phase of the Investigation, as I began to write up my thoughts and findings, I began to suspect that my initial research question about 'uniform' acquisition of 'technological capability' now appeared rather gauche to myself personally. I felt this because it appeared to sit uncomfortably with my emergent recognition of 'unique context' as being a seemingly vital dimension to acknowledge, in trying meaningfully to assess an individual's educational experience. From a personal perspective, this being particularly the case when looking at the impact specific dimensions of curriculum areas (in this case 'Design and Technology') may have on the development of student capability. This is a feeling I amplify subsequently ~ see 6.7.

2.0.5 The journey through this chapter visits several big issues. After articulating my own contextual influences as seen through my specialist subject now called 'design and technology', I highlight the issues of: postmodernism,

- globalisation
- Europe
- proactive management

and

- politics

indicating how they have impacted upon my own practice and philosophy over the past decade. It 'colours in' my own contextual backdrop.

2.0.6 Next I clarify 'geographic terms', as my original research question makes explicit reference to 'suburban' and 'rural'. Subsequently I address the notion of technology as being crisis, opportunity or both, in a section on 'determinism'. This makes explicit my belief that technology has an intrinsic social dimension. The following section then looks at societal constructs, and possible future contextual influences on education, such as: employment patterns, social class, postmodernism self-evaluation, environmentalism, change, and who makes decisions and on who's behalf.

2.0.7 As the chapter draws to a conclusion, I look at 'life beyond school' in terms of industry, culture and environment. This is done against the exploration of 'values', specifically as they relate to this Investigation, as providing a contextual anchor for reflection upon what it means to be human. A dimension often overlooked when discussing technology, technological capability, and design and technology education.

2.0.8 The Aims of this Chapter are:

- To undertake a 'literature review' of technological capability in different contexts, and discuss themes relevant to my practice as a design and technology educator. This provides further contextualisation for the discussion of 'Technological Capability' in Chapter 3.

- To engage in a discussion of teaching, thinking, learning and knowledge as they relate to this specific work.

- To provide the reader with an insight into personal and professional influences, providing contextual location for the Research Investigation, in conjunction with Appendix 2 ~ see 2.1, 2.2 and 2.3.

- To provide etymological clarity of issues relating to context, particularly to the geographic and social terms of 'rural' and 'suburban'.

- To locate broad issues relating to technological capability, as relevant to design and technological education, within a wider societal framework of industry, culture and the environment.

- To acknowledge the author's growing practice as a reflective practitioner by dealing explicitly with values, reflection and humanism, within the specific context of this study.

2.1 The development of Design & Technology ~ a practitioner's personal and political perspective.

2.1.0 *Design and Technology Education ~ contextual thoughts from 1985-1995*

2.1.1 In 1994, Bob Welch quoted the eminent educationalist, Matthew Arnold:

> "You will only find the Holy Grail if you believe in it."
> Welch (1994, p.12)

This is an important maxim for those people committed to developing high quality technological capability in pupils. Between the years of 1988 to 1995, as a practitioner involved in design and technological education the debate at times seemed to struggle to rise above the level of an unseemly internecine power struggle between the various subject factions that were forcibly enveloped under the title of the 'technology team' (Home Economics, Business Studies, Art, CDT and I.T.).

2.1.2 Reflecting back upon the mid-eighties, at times there seemed neither a clear understanding of what technology was from central government, nor any evidence of *esprit de corps* from those charged with the task of delivering this vital area of the curriculum that aimed to balance a child's scholastic diet. The educational press seemed liberally covered with whimsical quotes and anecdotes that seem to revel in the uncertainty that surrounded design and technology:

> "If you're not confused, you're not up to date".
> Blackburne (1985 p.14)

2.1.3 I remember feeling how important it should be that the voices of the visionaries were heard. For myself, Harrison and Black provided a clear set of useful values, defining Technology as:

> "a disciplined process using resources of materials, energy and natural phenomena to achieve human purposes. Its three aims are:
>
> to give children an awareness of technology and its implications as a resource for the achievement of human purpose.
>
> to develop in children, through personal experience, the practical capability to engage in technological activities.
>
> to help children acquire the resources of knowledge and intellectual and physical skills needed for technological activities."
> (1985, pp. 6-7)

2.1.4 Jim Flood, lecturer at Loughborough University and former Cambridgeshire Technology Adviser, delivered a lively lecture in Lincolnshire at which he vented his frustrations on the lack of drive and enthusiasm for technology. He reiterated his simple definitions for Design and Technology as:

> "Design : the use of modelling to explore new systems " and "Technology : is making things *work* better".
> Flood (1992)

2.1.5 Having trained at Loughborough University under Bill Elloway (a student of Edward Barnsley's) and John Smith (IDATER Conference Co-ordinator), fifteen years of practice has shown that I was fortunate in being encouraged to have a wide vision, and coherent philosophy, of Design and Technology education. I have drawn upon this emergent set of beliefs and values during times of change, to ensure that I always teach what I believe in, after critical reflection, enabling me to fit curriculum frameworks and syllabuses around my philosophy and not *vice-versa*. On a personal level, these types of definition gave a common identity to and *raison d'etre* for technology, at a time of acrimony and mistrust within both design and technology education and the profession as a whole, with change upon change being disgorged from the National Curriculum Council. All sadly failing to acknowledge the existence of the very people who would make the reforms succeed or fail, namely classroom teachers. As Stenhouse commented in 1985:

> "Only teachers can change teachers"
> Chiswell (1985, p.417)

2.1.6 Ken Baynes, another well respected authority from the creative design facet of the subject, also made an effective and thought provoking observation about design and technology in the late 1980's. I have found his writings to add *gravitas* to my perception of design and technology, as it emerged in the early 1990s.

2.1.7 In his lecture entitled "Alice in Design and Technology Land", delivered to the DATER Conference at Loughborough University in September 1990, Baynes argued for greater clarity of layout and philosophy in the National Curriculum for Technology. The lecture was punctuated with amusing parallels between developments in the direction of National Curriculum Technology and the antics of the Alice in Wonderland characters: White Knight, Mock Turtle, Gryphon and Tweedle-dum and Tweedle-dee. The latter pair he equated to the power struggle between Home Economics and CDT, and the harm it was doing at the time:

> " 'Tweedle-dum and Tweedle-dee
> Agreed to have a battle:
> For Tweedle-dum said Tweedle-dee
> Had spoiled his nice new rattle.'
>
> How refreshing it would be to find specialists who saw themselves first as Design and Technology teachers and only second as Home Economists or CDT specialists. Until the battle stops, it will be very hard indeed to achieve the aims of the Design and Technology curriculum."
> Baynes (1990, p.41)

2.1.8 Professor Alan Smithers, prepared an historical report for the Engineering Council that proved to be a '*zeitgeist'* for some of the scientifically inclined enablers in Design and Technology, bringing into sharp focus the problems over lack of clarity and direction in the emergent National Curriculum proposals for Design and Technology.

2.1.9 Although based on a very small amount of research, the report acted as a catalyst and re-focused national attention onto issues concerning quality, rigour and 'hands on' making skills, back to the epi-centre of the debate. Personally I found it regretful that the press instantly focused in on the quote about "Blue Peter technology" which quickly polarised opinions.

2.1.10 The Smithers and Robinson report seemed to contribute to a sharp *volte face* from the Government and Design and Technology was subjected to a radical and controversial restructuring, pre the Dearing review.

2.1.11 An overview of the years between 1985 and 1995 that portrays a situation of confusion reigning supreme over a potentially valuable balancing experience for pupils would be an injustice to the efforts that classroom practitioners made to ensure that, despite the political ructions, pupils were still designing and making quality products that were of good quality and actually worked. As discussed in 2.1.5, the importance of practitioners developing a coherent values framework underpinning a sound philosophy regarding design and technological education, was essential to continued good practice, particularly against such a background of micro, meso and macro political turmoil. One of my proudest achievements as a teacher has been an acknowledgement to myself that during the early 1990's pupils and students I taught did not suffer unduly as a result of the National Curriculum debacle.

2.1.12 A positive evaluation of the subject being established within the foundation curriculum for all pupils in England and Wales, reveals a lasting elevation of status amongst parents, pupils and colleagues. It has been the subject of much subsequent enthusiasm ~ see 1.2.1.

2.1.13 Having summarised my own operational context over the last decade, I will now guide the reader through a wider contextual analysis of the climate within which education and technological capability had been developing over the same timescale (the decade from 1988 to 1998).

2.2 Emergent Contextual Themes from the Literature Review on Technological Capability.

2.2.0 *Context, Terms, Determinism, Societal Constructs, Industry, Culture, Environment and Values & Humanity.*

2.2.1 Context ~ a discussion building upon Ed.D. 'Taught Modules'

2.2.2 For a detailed explanation of taught module content please refer to Appendix 6.1, where a copy of my summative 'Coherence and Integration Report III' draws together the various facets of the taught modules, indicating also how they impact upon the other aspects of the Ed.D.

2.2.3 In setting this Investigation into context it seemed natural to explore the notion of context within this chapter, particularly as contexts (rural and suburban) formed part of my original research proposal ~ see 1.3.6.

CONTEXTS AND EDUCATIONAL RESEARCH

2.2.4 Educational research, involving both society and technology can often elicit some sobering perspectives. Layton (Op. Cit., p.113) estimates that by the Year 2000, 66% of all jobs will be knowledge based. Holcomb (1995, p.41) contends that two-thirds of today's jobs didn't exist a generation ago. In such a climate, should such statistics prove valid, children need to be equipped with different knowledge and thinking skills, by learning and teaching processes that are radically different to those of previous generations. The reality of the 'Information Superhighway' is perhaps proof enough that education is undergoing a serious ontological examination by 'Infonauts' ~ see Luke (1997, p.17) who possess a well developed sense of 'nettiquette' (Ibid. p.4) within our society.

2.2.5 Building upon Foucault's (1980) notion of the micro-circulations of power, Conduit et al (1996, p.199) contend that pupils and students who are less institutionally dependant than their forbears, may need to be taught how to interact at micro (personal), meso (school), macro (wider educational) and exo (community) level situations. Conduit suggests that there appears to be a growing link between the meso and exo levels within English urban secondary schools. That there is a long established link in rural schools is not disputed in his article.

2.2.6 With the metamorphosis of the 'Common Market' into the 'European Union', it has become evident to myself as a VI form tutor, guiding students into further and higher education, that many of the old xenophobic stereotypes of the post-war years seem to be in regression.

Stephenson (1993d, pp.17-19) confirms this viewpoint and lays out five principles for ensuring that such a perspective continues to develop. He contends that access to higher education, partnerships with economic institutions, continuing education, open/distance learning and discrete European dimensions within education will help to develop capability within students across the Continent.

2.2.7 I have come to realise through the doctoral journey that as an educator what is required is a child-centred approach to learning, not as envisaged by Plowden, where discovery learning appeared to hand to children the opportunity to decide what they wanted to learn in the sense of what they chose to be exposed to, but accompanied instead by a coherent series of strategies and styles of teaching that draws knowledge and capability from within pupils and students, instead of perpetuating the myth that they are empty vessels ready to be filled up. Given that the word education comes from the Latin word '*educerae'* meaning to draw out, perhaps I can appreciate the irony of being a teacher of such a 'new' subject (National Curriculum Design and Technology) on the curriculum looking to 'ancient civilisations' for inspiration of how best to teach the technologists of tomorrow to cope with such rapid change ~ see Appendix 2.1. It is certainly one way of countering the 'Gee Whiz - High Five' magic of science and technology perception that Custer (Op. Cit., p.219) finds engrained within Western modernist culture. A point alluded to by Winner (1977) when he notes that:

> "...we don't so much <u>use</u> as <u>live</u> our artefacts. We move heedless, through a jungle of our creations, like sleepwalkers."
> Barnett (1995, p.127)

2.2.8 Having noted the contextual impact that Europe is having on Education, I engaged with interest in the work done in the taught module on 'Ways of Seeing' regarding globalisation issues. Kumar (1996, pp. 1-3) notes that Japan makes the largest input of foreign direct investment (FDI) into Asian developing countries. It is postulated that there is a link between FDI, local technological capability and technological imports. Whilst keen to explore this in greater detail, it is beyond the scope of this Investigation to do so. However, that the development of the European Union will continue to impact upon education and, by extension, student capability is, in my opinion, going to prove irreversible.

THE MESO-POLITICAL CONTEXT OF EDUCATION

2.2.9 In focusing down from the macro-politics of education within international and globalised contexts, I contend that before I concentrate on the micro-context of my own highly specialised, small scale research there is a need to explore the meso-political context of schooling during the last two decades of the twentieth century. The influence of the Conservative party, with their unbroken run of electoral successes, ensured they were in power for 18 years, from May 1979 until May 1997. A personal perspective reveals there to be two central planks of Conservative education policy during this period that I perceive as having had an effect on the development of design and technology education.

2.2.10 I discern that both impact upon this Investigation. The first issue concerns the notion of 'highly structured' management of both the process of education and the people that work within it. Industrial management techniques, such as re-engineering - see for example Appleberry (1995), Total Quality Management (TQM) - see for example Davies (1994), and School Development Planning - as apparently eulogised by Ofsted and the DFEE. The second issue overlaps with the first and concerns the City Technology Colleges initiative, targeted in its initial stage specifically at Urban Inner-city areas.

2.2.11 The phrase 'human resource management' (HRM) is one I have some personal difficulty with. My Christian beliefs lead me to see each child as a unique individual. Organisations, in my experience, best function when each person has a voice and wherever possible decisions are reached collegially. The pragmatist in me acknowledges that there are occasions when managers need to manage and difficult decisions need to be taken. However a philosophy of inclusion and consultation does not appear to sit well with 'off the peg' management solutions, such as TQM. The use of HRM brings to mind an image from the film 'Schindler's List', where Oskar Schindler is on horseback looking down on Nazi troops herding the Jewish inhabitants of a Krakow 'ghetto'.

2.2.12 Willower (1997, p.443) posits that solutions like TQM (pregiven solutions) are the antithesis of praxis. He further contends that 'thoughtful practice' attends to contingencies, conflicting perceptions and special circumstances. My own belief is grounded in over fifteen years of personal experience and finds support in the work of Kay (1994, p.71) who also acknowledges that thinking schools are *self*-evaluative; schools need friends and supportive networks, not critics. Kniveton (1996, p.95) illustrates the benefits of my collegial approach by stressing that in established relationships we complement each other, we don't simply 'add to' in some numerate, or hierarchical sense. Although an element of the 'Management of Change' module in Year 3 of the taught course covered *'strategic planning'* (including aspects such as TQM and HRM) I respectfully listened and engaged with the work, but was exposed to nothing that caused me to change my perception of such solutions as being 'bought in' or 'off the peg' concepts. I felt that, as imposed solutions, they would fail to grasp the subtleties and nuances of each individual, dynamic and complex context.

2.2.13 I do not contend that all 'Thatcherism' strove to do, had a negative effect on education. In the same way that a previous Prime-Minister, James Callaghan ~ see Appendix 2.1, expressed genuine commitment to education as being central to a successful society or country, Thatcher's 'five themes' for education: quality, diversity, parental choice, school autonomy and accountability - see Chitty, Weiner and Gleeson (1994, p.415), are issues that I feel to have an affinity with. I do, however, have some difficulty in equating the notion of 'school autonomy' with the lack of consultation afforded to classroom teachers during the introduction of the National Curriculum circa the late 1980s and early 1990s.

2.2.14 I do not adopt a party political stance on such issues. I have the same concerns regarding 'New' Labour's proposals on the restructuring of the profession. I posit that notion of 'Advanced Skills Teachers', pejoratively implies that others are in some way 'less skilled'. My contention is that this is anathema to a collegiate profession. I do not argue that we are all equal to each other, simply that we as educators are all individuals and all play our part as subject specialists (in secondary education) in developing the whole child.

2.2.15 I have difficulty seeing how it is possible to extract out one part of a child's education and contend that it is quantifiably better than another. Practice leads me to contend that subjects collide into each other and feed off each other holistically rather than in an atomised quantification. The whole, I contend, is greater than the sum of its constituent parts.

2.2.16 The second issue I noted as important to this Investigation, regarding the meso-political context of education was the City Technology Colleges (CTC) initiative. Two informative perspectives on the subject are given by Witty, Edwards and Gerwitz (1993) and Chitty, Weiner and Gleeson (Op. Cit.). There are many interesting statistics surrounding the initiative. Chitty (Op. Cit., p.419), noted that there was more tax payers money spent on 14 CTC's than was spent on all other schools for the implementation of the National Curriculum. Chitty (Op. Cit., p.411) observes the 'Chutzpa' (Chitty's term) of spending as much on 4 CTC's as on the other 1218 other schools in the corresponding 4 LEA's. Despite further promotion of the initiative and an attempt to broaden its appeal to suburbia and rural communities, Chitty (Op. Cit., p. 418), notes that the initiative accounts for less than 10% of all schools. He also questions whether the philosophy underpinning the movement was not to:

> "technologise the curriculum and vocationalise the students."
> Chitty (Op. Cit., p.416).

2.2.17 That the initiative changed the relationships between Government, LEA's, schools and families is not questioned, what must be questioned is the long term benefit of such projects, given the skewed funding. I would contend that such funding, distributed to context sensitive LEA's, whose very nature it is to function within localities, might have contributed as much, if not more effectively, to the Thatcher aims mentioned in 2.2.13. A final poignant comment from Chitty (Op. Cit., p.411) reveals that with their reliance on technological artefacts and industrial management techniques:

> "the products of the CTCs may become the Bob Cratchits of the future: 'tied to their computer screens for the rest of their lives without even the Victorian clerk's pride in his handwriting'."
> O'Hear (Quoted in Regan, 1990, p.36)

2.2.18 A personal perspective that I have held for many years on the CTC initiative has enabled me to look at the interplay between context, skills acquisition and the process of teaching. I was curious to observe whether an institution could be built over a short period of time, be staffed from outside of its local environment and be run along industrial management lines regardless of the inner city urban community it was to serve. As the CTC's themselves have evolved, e.g. their subsequent appointments of Principals from educational backgrounds, it suggests that they may have moved more into line with state schools, with regard to management structure.

2.2.19 I believe my curiosity was part satisfied when shortly after opening, the CTC situated within the LEA I was then working for, made an application to widen their local catchment to include the whole of a city. I was unsure as to whether this indicated that parents had turned their back on a central government initiative that lacked community consultation to start with, or whether having sampled the 'new' approach for a short time, parents trusted or preferred the established LEA provision. Whichever were the case, it intrigued me to think about the extent to which local environment impacts upon the learning process. The fact that I have taught in four different schools, in different settings, also contributed to my perceptions at the time. Messner (1995, p.5) thinks:

> "Technology should be viewed neither in isolation from the context in which it emerges nor from the organizational structures in which it is used. Technology does not arise in a vacuum, it invariably emerges in determinate social contexts. It is never neutral in that it is developed in connection with specific (economic, social and political) interests. - Technology often embodies organizational factors."

2.2.20 The literature search I undertook for this Investigation confirms my feeling that context appears to be a vital ingredient in education. A strong mover in the Higher Education for Capability (HEC) movement, Stephenson (1994b, p.2) ~ see also Harrison et al (1986, p.197), notes that process skills are not developed in a vacuum, they are only real when contextualised. He further contends that the interplay between knowledge, values, self-esteem and the capacity for the autonomous development of the self and context are inextricably linked when discussing capability. Williams (1993, p.48) defines the development of skills within a specific context, that may or may not be transferable to other contexts, as 'multi-skilling'.

THE INTERPLAY BETWEEN CONTEXT AND TEACHING

2.2.21 Moving on from context specificity *vis-a-vis* skills, to consider teaching, Swann and Brown (1997, p.109) define an 'experienced teacher' as one who can look at pupil progress and take account of what conditions are perceived to be salient in a given context. Developing this theme, Gill (1991, p.36) thinks that when problem-solving, the context should be that of a problem and not simply restricted to one particular area. Experience leads me to believe that this is perhaps more readily achieved in the Primary curriculum, sooner than at Key stages 3, 4 or post-16 in the Secondary phase. The Technology Resources Centre of Northern Ireland (1998, p.4) believe that when teaching it is important to begin with the school context and progressively work out widely from there.

2.2.22 According to Hendley and Lyle (1995, p.370) learning is most successful when embedded in contexts relevant to participants. Similarly, enabling children to see the wider contexts of their work is what Newby (1996, p.43) describes as a 'quality learning objective'. Gill (Op. Cit., p.36) maintains that pupils see investigative and problem solving work as being defined by context. Regarding specific subjects, Luke (Op. Cit., p.8) notes that technological education cannot ignore contextual dimensions of technological uses and skills. This is a theme that is explored in some detail in a subsequent section of this chapter.

2.2.23 In section 2.3 ~ see 2.3.34, I engage in an exploration of thinking, as it impacts upon this investigation. The concept of Critical Thinking is one model that I discuss; Splitter (1991, p.90) believes that the <u>what</u> of critical thinking must be sensitive to context. Girle (1991, p.51) in a paper analysing the interplay between dialogue and reasoning develops five foci for 'dialogue logic': i) making assertions ~ <u>always within a context</u>, ii) giving and evaluating reasons, iii) asking and answering questions, iv) explaining and withdrawing assertions and v) changing commitments.

2.2.24 My principal research question cited 'rural' and 'suburban' as potential contextual influences on design and technological capability. In acknowledgement of this, I posited that it was necessary to clarify these terms by conducting an etymological analysis.

2.2.25 **Terms ~ A Geographic Etymology**

2.2.26 As this Investigation questions the impact of two specific contexts upon the educational process, it quickly became clear that an etymological study of the terms '*Rural*' and '*Suburban*' was necessary. This section explores word definitions for the purpose of clarification. As well as the two principal words, associated terms will be analysed.

2.2.27 *Rural* ~ In their New English Dictionary (1997, p.379), Collins describe the word 'rural' as an adjective. It is derived from the Latin word '*ruralis'*, meaning in or of the countryside. Goodall (1987, p.417) postulates that there is:

> "…no agreed quantitative definition of rural. Parts of a country that show unmistakable signs of domination by extensive land use (now or in the past)."

2.2.28 *Urban* ~ Collins (Op. Cit., p.868) define 'urban' as an adjective also. It is derived from the Latin word *'urbs'* meaning of or living in a city or town. Fraser (1995) explains that in Britain the Industrial Revolution turned an agrarian society into an urban industrial society. Freeman (1995) observes that at this time the country was rapidly 'urbanized', with 70% of the population living and working in 10% of the total land area. Goodall (Op. Cit., p.488) uses the following statistics to define an urban area:

"physical characteristics ~ i) size and density of continuous built up area (386 per km^2)(1000 per ml^2), ii) functional criteria reflecting concentration of employment in secondary and tertiary activity."

2.2.29 Although we think of '*urban planning*' as a relatively recent phenomena Vigier (1995) points to the first example as occurring in the Indian Fertile Crescent around 4000- 5000 B.C.. He further contends that in the time of Plato, Hippocrates and Aristotle (circa 4-5000 B.C.) its use was well established.

2.2.30 The term '*urban anthropology*', according to Schecter (1995) is a subfield of cultural anthropology and is concerned with having a focus on the city as a locus of research. This may prove useful to this Investigation, as Schecter points to the effectiveness of participant observation, questionnaire and survey in the gathering of data.

2.2.31 According to Park (1995) The term '*stratified society*' is useful when analysing urban industrial societies. He contends that such societies defy conceptualisation, due to complexity and 'sprawl', to overcome this towns or villages are often used with a view to them representing regional characteristics.

2.2.32 *Suburb* ~ is defined by Fava (1995) as:

"an outlying community socially and economically linked to a nearby city. It depends on rapid flexible modes of transport and communication, especially: car, lorry and telephone."

Relevant to the term suburban is the concept of '*zoning*'. Hosken (1995b) notes that in an urban/suburban municipality zone there is an area or region considered separate or distinct due to its use or features. Such 'zones' may enforce special regulations.

Connected to the concept of 'suburb' is the term *'Ruban Fringe'*. Goodall (Op. Cit., p.418) describes this specialist term as a frontier of discontinuity between city and country in which rural and urban land uses are intermixed.

2.2.33 The last terms of interest in this section concern *'Population'.* Keyfitz (1995) defines this as a group of individuals subject to birth, marriage or death. Usually defined territorially. He contends that as technology becomes more sophisticated, so the population increases. Allied to this concept is *'sociometry'* which Douglas (1995) describes as the measurement of groups. He states that when a group becomes 7 or more in number then role specialisms begin to develop. This was a useful fact to bear in mind when I conducted my field interviews in May 1999. Both of the student groups selected were less than 7 in number, including teachers.

2.2.34 This section of my Investigation proved to be more beneficial to my work than I originally thought. It helped to clarify my original research question, impacted upon the type of field interviews that I conducted and provided one of a number of focal points when structuring the 'writing up' of the study. Using knowledge gained, I drew up lists of schools that fell within the definitions of 'rural' and 'suburban' as clarified in this section. My chosen sample was then culled from these lists. The definitions cited in 2.2.27 (Rural) and 2.2.32 (Suburban) were the guiding principles and means by which I categorised schools, and eventually made my choice of schools. 'Rural' I took to mean domination by extensive land use, 'Suburban' I took to mean outlying community socially and economically linked to a nearby city.

2.2.35 Having covered context in terms of extrinsic geographic definitions, I now move on to discuss the contextual 'feelings' that are associated with the notion of technology within society. Technology is often portrayed as being polarised into an emancipatory or deterministic entity. Balance dictates that my own personal perception of technology as a 'force of good' or freedom seeking needs to be balanced by a brief resume of the notion of technology as determinism.

2.2.36 **Determinism**

2.2.37 Two questions posed by Hansen and Froelich (Op. Cit.) sum up the reason for including determinism within this contextual section. They ask 'Is technology ubiquitous?', 'Is its presence crisis, opportunity, or both?'. Whatever an individual decides are the answers to these questions, there are societal and, by inference, educational implications for each scenario.

2.2.38 Custer (Op. Cit., p.240) looks at the issue of technological determinism and draws upon the views of Heidegger:

> "Technology advances faster and faster and can never be stopped. In all areas man will be tightly encircled by the forces of technology. These forces have long since moved beyond his will and have outgrown his capacity for decision.'
> Heidegger (1966)

Although written over a third of a century ago this issue is still a contentious one. If this somewhat pessimistic perspective underpinned a teacher's philosophy, then educating to manage change and flexibly apply skills across such technological developments would not be to the fore. An approach teaching children to 'cope' with the aftermath of change may well be the logical thing to do, given this scenario.

2.2.39 In an article on the historical development of technology education, Custer (Ibid., p.241) posits that determinism must be balanced by an analysis of the impact of culture on technology.

2.2.40 If the notion of determinism, and its implications for education, is found not to be palatable then the notion of technology as 'volition' seems to provide a polemical stance. This is discussed in detail in the next chapter ~ see 3.9. This perspective is based upon the notion of technology creating emergent political and social structures, changes that create a demand for individuals who think critically, synthesise knowledge, become life-long learners and solve problems. It is a perspective that embraces technology and places it at the heart of changes. If education is to have an influence over the evolution of society then these polarised views, or a dialectic perspective needs to be considered when ascertaining the types of skills we think are desirable for children at the start of a new millennium, and by inferential extension what might constitute technological capability in the future.

2.2.41 **Societal Constructs ~ possible future influences**

2.2.42 Having looked at the types of effect technology may have on society, I suggest that a brief discussion of some issues may come to dominate society in the future, based on current issues of concern regarding a 'learning society'.

SOCIETY AND ITS CITIZENS

2.2.43 Stephenson (1993d, p.20) argues that a society of progress and change needs people who are independently capable. Waks (1996, p.287) observes that if we lose our sense of society and faith in direction then the ground for education is pulled from under our feet. Whilst Custer (Op. Cit., p.241) thinks that technological influence on society is more subtle than overt, Eggleston (Op. Cit., p.63) is in no doubt that in modern society technology equates to power.

2.2.44 If teachers plan lessons with social or environmental problems of technology in mind, Hansen (Op. Cit., p.39) argues that they are providing pupils with an 'orientation to key problems', instead of a diet dominated by theoretical concepts. Pennington et al (Op. Cit., p.2) develops this point by suggesting that a future learning society will have to consider the rate of technological change and exactly what effect this has on organisational structures and on the nature of work itself.

2.2.45 The current political language from 'New' Labour speaks of 'Citizenship' to encourage the development of responsibility towards one's community. Collaboration and consultation are two vital ingredients of a cohesive society, according to Estelle Morris (1997, p.9). It is somewhat ironic that once in power, Estelle Morris MP should be one of the architects of the apparently divisive DFEE (1999) Green Paper on 'teachers pay and performance management' - see 2.2.14. According to Learmonth (1997, p.58), Chris Woodhead, the Chief Inspector for Schools, does not appear to espouse a coherent philosophy regarding the issue of citizenship as it relates to education. He (Learmonth) has difficulty deciding on what is policy and what is personal view amongst Woodhead's 'ramblings' on the subject of community.

2.2.46 According to MacBeath (1997, p.72) an 'intelligent society' is one where more self evaluation equates to more intelligence. He contends that education must be child-centred and that teachers lie at the centre of future history. Brandwein (1977, p.136) asserts that a child arrives at school with constructs, some of which are profoundly wrong. He sees it as the task of the teacher to help correct faults in such societal constructs. This point is affirmed by Willower (Op. Cit., p.441) who believes that social constructivism is a result of cultural, personal experiences and predilection. If, as Fanning (1994, p.2) suggests, technology is one of the principal factors determining <u>how</u> people will experience the world, then Haraway (1991, pp.161-201) asserts that the 'informatics of domination' has transformed society into a 'polymorphous information system'. Such a society, Haraway explains, relies on the encouragement of students to evolve into 'coding tricksters' who 'become actors and agents in the mediation of their own knowledges and subjectivities'.

SCHOOLS AND THE COMMUNITIES THEY SERVE

2.2.47 When discussing education in terms of societal constructs, Ball (1997, p.323), appears to adopt a postmodernist stance in contending that in the 1990s education takes place against widely differentiated needs of the communities that schools serve. There is, according to Ball, no monolithic vision that can be successfully espoused from the centre, to benefit civil society. Whilst Conduit et al (Op. Cit., p.205), assert that rural communities produce less stratification than urban and suburban areas, Olmedo (1997, p.249) notes that some commentators are shocked to find urban values affirming education and their associated agencies. Such observations are later confirmed in this Investigation ~ see Chapter 6, in that I found no marked difference in the acquisition of technological capability between 'rural' and 'suburban' students.

2.2.48 For Biggart & Furlong (1996, pp.254-7) unemployment is the most important factor in determining effectiveness of education. They define a 'discouraged worker effect' in high unemployment areas, regardless of location, where fewer pupils leave school for work at the age of 16. The same paper (p.256) reports no difference in high fliers across different areas. However, for mid and lower attainers, area differences did appear to have an effect. Biggart and Furlong also note that, whereas working class responses to school and job markets used to be collectivist, they are now considerably more individualised. Having acknowledged this the authors finish their paper by suggesting three 'new' categories of students in the modern education system: '*high-flyers*', '*plodders*' and '*drifters*'. They suggest the challenge is to engage all in a curriculum that is relevant and accessible to all groups.

2.2.49 In measuring the social class of students, I endeavour to be very sensitive to the process, as I am from a 'traditional' urban working class manual skilled family. The fairest model I have come across to analyse social class is the 'Townsend Index' - see Conduit et al (Op. Cit., pp.199-206). This model takes a range of indicators, such as percentage of economically active adults, number without a car, number of private houses not owner occupied and number of houses with more than one person to a room. Townsend contends that social class is a 'continuous variable' and not a well defined 'stratified hierarchy'. Whilst I did not use the Townsend Index in the research, my awareness of it acted as an *'aide memoir'* when designing the research instruments and capturing the data. The original research question and available time prevented this featuring as an issue in this particular Investigation.

SOCIETY, TECHNOLOGY AND TECHNOLOGICAL EDUCATION

2.2.50 Regarding technological education and society, I was interested in one idea underpinning an initiative in the United States of America called 'Technology for All Americans' (TFAA) (1998, p.1), a NASA (Space Program) sponsored initiative to create a national framework for the teaching of technology. Whilst most of the framework was applicable to the whole country, there is provision for each state to make a substantive local interpretation, to enrich the particular or local needs of their students.

2.2.51 A parallel initiative in the USA called Science for All Americans (SFAA) (1998, p.2) recommends three themes regarding the interrelationship of science, technology and society. Firstly to connect up science and technology within schools in a more systematic way, secondly to make clear what the principles of technological education are and thirdly to connect together science, technology and society.

2.2.52 The social nature of technology is affective on three levels according to Luke (Op. Cit., pp.6-7). The basic level is concerned with physical objects, their design and usage. Secondly in the social activities that come from and shape social contexts in particular technologies. The last level acknowledges that technologies imply knowledge connected to social activities and relations, and to objects (for example market research, etc.).

2.2.53 One of the major aims of technological literacy in North America, according to Saskatchewan Province (1998, pp.1-7). is to:

> "...achieve an informed, balanced and comprehensive analysis of the technological influences on their lives and then be able to act on the basis of their analysis... technology shapes and is shaped by society... technological issues involve conflicting assumptions, interpretations and option...*(students must have):* the necessary data collection and decision making skills to make intelligent choices, ...the ability and desire to take responsible action on social issues.'

This double edged interplay of technology and society leads to one aim of their technology curriculum to make students critically aware of who makes decisions and from what bias. They also assert that value claims are implicit in positions regarding technological development. Values are discussed in detail in section 2.2.77.

2.2.54 SFAA (Op. Cit., p.1) assert that:

> "Many global and local problems have technological origins, technology provides the tools for dealing with such problems, and the instruments for generating, through science, crucial new knowledge. Without the continuous development and creative use of new technologies, society may limit its capacity for survival and for working toward a world in which the human species is at peace with it self and its environment.'

2.2.55 There are both social and technical contexts connected to the purposes of technical literacy, according to Wright (1998, p.1). He posits that the social context revolves around the dynamics of decision making in a democratic society, and the holistic interplay of political, economic and social factors. The technical context is mainly concerned with engineers and vocationalists utilising technology through the vehicles of education, business and industry. There are interesting parallels between developments in the United States of America and those highlighted in sections 2.1, 3.5 and 3.6. It is therefore an emergent contention that technological capability (technological literacy in the United States of America) could be said to potentially possess an inherently context specific dimension that both shapes and is shaped by the surroundings within which individuals both acquire and apply the technological knowledge, skills and understanding. This being the case, I further contend that the implication for the conclusion of this Investigation was profound. See Chapter 6 ~ section 6.7.

2.2.56 Having given consideration to the relationship between education and the wider context of society, the next section of this chapter focuses down upon the intended main benefactors of education, the students. This includes a consideration of how the education they are exposed to, or required to interact with, may aid the individual to develop their career in post 18 education or employment.

2.2.57 **Life Beyond School ~ Capability for what exactly ?**

2.2.58 As I read around the subject of capability there were three broad themes or groupings that emerged when considering, Capability for what, exactly? The first is bound up with the roots of technological education, *Industry* and practical application within a utilitarian paradigm. Secondly, building upon the work of the taught doctoral module on 'Ways of Seeing' , the notion of *culture* became a tangible facet of the exploration of capability, as such I felt I needed to make this explicit. The third discernible area was concerned with issues of the *environment*, in terms not only of both the protectivist/exploitative resources issue, but also in terms of the locality within which particular technologies or individuals are contextualised. This section focuses down upon students: their needs, wants and possible aspirations.

2.2.59 **Industry**

2.2.60 The Royal Society for the Encouragement of Arts, Manufactures, and Commerce assert that:

> "There exists in its own right a culture that is concerned with doing, making and organising and the creative arts. This culture emphasises the day-to-day management of affairs, the formulation and solution of problems and the design, manufacture and marketing of goods and services... Educators should spend more time preparing people in this way for a life outside the education system. The country would significantly benefit"
> (RSEAMC) (1994, p.1)

These thoughts were originally expressed in the 'Education for Capability' Manifesto, in 1980. At the same time a defining moment in British political history appeared to occur, when Thatcherism was in its infancy and a radical restructuring of industry was about to be undertaken. It was a time of anticipation and subsequently, great change. Education became subject to market forces, industry and business had a greater influence on educational practice ~ see 2.2.15 - 17, and design and technology acquired parity of esteem along side other 'traditional' curriculum subjects ~ see section 1.2.1 and Appendix 2.3.

2.2.61 The difference between the terms 'Industry' and 'Business' for Davies (Op. Cit., p.20), are significant. '*Industry*' (usually accepted as broad in scope), it is argued, is a context, whereas '*Business*' (a term denoting specific procedures, e.g., marketing) refers to ways of operating within that context. Wellington (1994, p.319) asserts that though the term 'Industry' may be widely understood, the phrase 'needs of industry' has little meaning in real terms, even when generalised to pertain to skills transference.

2.2.62 Discussing schools within an Industrial paradigm was personally informative, for instance, Fanning (Op. Cit., p.3) considers that schools are based on an outmoded 'industrial age' model, where conformity and compliance appear to be valued more than originality and independence. Fanning equates independent understanding with a flow and control of information, the sorting of ideas, things and people. Custer (Op. Cit., p.229) argues that for the academic community, knowledge has predominated as the primary outcome over political and economic goals, interests and values.

2.2.63 Although a champion of closer links between industrialism and education, Sir Ron Dearing failed to place design and technology centre stage in the education of all pupils in England and Wales, when his review of the National Curriculum in 1995 required schools to offer only short courses in design and technology to their pupils. Sir Ron had noted:

> "In the case of technology, as a nation we have a distinguished record in scientific discovery and a proud record amongst the world's Nobel Prize winners, but we have suffered from an inability to translate scientific discovery into wealth-generating industrial and commercial products. This has weakened the whole economy."
> Layton (1995, p.111)

This vision is shared by Shield (1998, p.1), who acknowledges that the need for schools and universities to make innovative wealth creators will have ramifications, regarding subject content and delivery.

2.2.64 Two perspectives on the future interplay between education and industry are provided by President William Jefferson Clinton and Kay Stables. Stables (Op. Cit., p.125) thinks that our future existence is bound up in the interplay between technology, ecology and the economy. The ecological aspects will be picked up in 2.2.72. President Clinton (1997, p.1) thinks all technologically literate students must master 'computers and other technologies', to improve learning performance and productivity. Such a notion, I suggest, may help to discern how society interacts with technology to help clarify the evolutionary definition of culture, at a specific point in time.

2.2.65 As indicated in section 2.2.55, my growing belief in the centrality of context specificity in the acquisition of 'technological capability' would lead me to suggest that that Whilst Clinton's assertion that all 'technologically literate' students must master computer skills and other technologies, of equal importance, in my opinion, is the need to ensure that due acknowledgement is given to local contexts. Caution needs to be exercised when considering curricular issues that are imposed nationally. Blanket imposition, without trialling, is, in my opinion, fraught with dangers, some of which may be avoidable.

2.2.66 **Culture**

2.2.67 Orienting young people to the full diversity of human culture is, according to Custer (Op. Cit., p.225), a critical purpose of education. Barnett (1995, p.128) argues that in studying the human condition, there is a need for a 'new humanist' perspective, where there is greater clarity and definition between the terms 'nature' and 'culture'. Fanning (Op. Cit., p.3) offers clarity by noting that culture defines who we are and what we do. They are the 'raw processes' for doing, imaging and communicating. According to Handy (1986, p.49), if youths experience several changes of culture, they become inoculated to change for their adult life. One closed environment is not good for individuals who will later be subjected to open environments.

2.2.68 Technology education has a specific role to play in the development of culture, according to Custer (Op. Cit., p. 241). It should be part of the general education of all children. A way of exposing them to the rich diversity of culture and experience. However, as Nuttgens (1986, p.26) cautions, becoming deeply involved with design and technology in the

16th, 17th, 18th and 19th Centuries was not seen as a route to culture. Mason (1996, p.4) points to increasing internationalisation as causing cross-cultural awareness and sensitivity, thereby breaking down the traditional bar to cultural acceptability that technology has always rubbed up against in British Society. Mason cites international team-working, openness and receptivity to other ways of thinking and doing as being vital to the erosion of such barriers.

2.2.69 In 1989 a report into the teaching of English was produced by the Cox Committee, defining the English Curriculum as being ostensibly about:

> "skills, adult needs, cultural heritage, personal growth and cultural analysis."
> Barnes (1997, p.35)

The notion of implicit curricular recognition of culture is discussed by Gill and Murray (1992, pp. 21-23). They use the term 'Sociocultural effects' to describe knowledge acquisition processes that are embedded in social contexts. Chitty, Weiner and Gleeson (Op. Cit., p.419) broaden this notion out by suggesting that legislation and policy making is driven by the complex interplay of cultural, economic, political and other forces.

2.2.70 The work of anthropologist Clifford Geertz acknowledges, according to Bruner (1987, p.90), that acting within a culture is like interpreting an ambiguous text. In the 'Ways of Seeing' module on the taught part of the doctoral program, we were encouraged to look at the work of Derrida on the deconstruction of texts. Whilst a detailed analysis of culture is beyond the remit of this Investigation, I feel it is important to acknowledge formally that culture is a societal feature that has a bearing on the nature and outcomes of technological activity.

2.2.71 Across the three years of the 'Ways of Seeing' module we also explored how different societies viewed culture and how they interacted with their environment.

2.2.72 **Environment**

2.2.73 The Technology Resources Centre of Northern Ireland (TRCNI) (Op. Cit., p.1) articulate that to a great extent the environment is shaped by technology and it isn't sufficient to assume students will acquire capability by 'passive diffusion' or by 'osmosis through immersion'. Radaburgh (1998, p.2) echoes this in suggesting that technological literacy should be concerned with addressing the needs of society, individuals and the environment.

2.2.74 Technology is defined in Newfoundland and Labrador Department of Education as:

> "a uniquely human endeavour. It is a conscious process by which people alter their environments. People use tools, materials and processes to create and modify artifacts, systems and environments. They interact with technology to extend human capabilities… Technology modifies, and is modified by, all human activities… all of our belongings, all the trappings of contemporary society are a result of technological activity."
> (1988a, p.1)

They broaden this definition to suggest that technology cannot be separated from culture. It is noted that practices, customs and relationships evolve, based on technologies of transport, communications and production amongst others.

2.2.75 The importance of environment is acknowledged in an article from the Basque region of Spain, regarding technological innovation within Small and Medium Enterprises (SMEs). When undertaking an 'innovation diagnosis', SPRI (1998. P.1), assert that a key aspect of such diagnoses is a thorough analysis of the environment in which the diagnosis is proposed to be effected.

2.2.76 From the above discussion of the concept of 'environment', and its contextual importance regarding technological capability, education and modern business practice, I have a clearer understanding of the notion of a perceived link between context and environment. As I imply in the proceeding section, such a link informs the exploration of values and reflection. In such a discussion I feel it necessary to explore how I, as a unique individual, existing within specific contexts, interpret the notion of humanism.

2.2.77 **Values**

2.2.78 As a backdrop to my work on values within the context of this Investigation I drew heavily upon my Master of Arts thesis ~ see Atkinson (1996, pp.16-33), which defines a personal interpretation of the term *values*. As my reading across a whole range of subjects for this Investigation began to create links between emergent themes and ideas, I noted how the notion of reflectivity appeared as though it may have a bearing upon one's own values and how values develop. I posit that without constant reflective contemplation on both practice and philosophy, the prospect of refining one's own values may appear difficult to sustain. Issues of *Reflection and the mind* is another facet of contextuality I would like briefly to consider. In the third strand of this section I look at the notion of *Humanism*, from a unique and personal perspective.

2.2.79 The work of Milton Rokeach on the development of the terminal and instrumental values in the model now known as the 'Rokeach Values' ~ see Atkinson (Op. Cit., p.19), has been influential in the development of my own perception of the role values has to play in my professional practice. The work of Mumford (1981) builds upon, yet simplifies, the work of Rokeach, thereby possibly making it more accessible to practitioners. Mumford develops the notion that there are ten categories of values and supplies sample values for each category ~ see Atkinson (Op. Cit., p.16).

2.2.80 In narrowing down the discussion of values as they pertain to this particular Investigation, Conway (1994, p.111) identifies three sets of values that contextualise the purposes behind design and technological education. *Firstly,* Conway argues that there is a rational materialistic or economic focus that some see as the justification for the presence of design and technology on the curriculum. *Secondly*, Conway discusses the perspective that sees design and technology as being an adventure concerning the exploitation of frontiers of capability and virtuosity (commonly referred to as 'performing at the cutting edge'). The *third* perspective Conway discerns is concerning the attitudes and needs of users. If productivity concerns maximising gain, and copeability concerns minimising disaster then user need is concerned with attitude, perception and interaction. My earlier discussion of contextual interaction - see 2.2.4, is pertinent to this observation.

2.2.81 The complex interplay between values and design and technological activity leads to Waks (1994, p.38) suggesting that the positive valuing of technology is integral to a specific and locally constructed shared values framework, therefore suggesting that values issues could not be examined seriously in university studies. Whilst not being convinced that values cannot be a central feature of teacher training, I do share the view of Waks that such frameworks must be constructed and be as inclusive as possible at the local level.

2.2.82 The work of Tutton (1997, p.41) highlights the need to acknowledge that all children are born curious and stay curious. Tutton suggests that a key feature of any programme is its underlying conceptual framework. It is at this level that issues of values, beliefs and citizenship need to be intrinsically addressed, not as a bolt on afterthought. As I drafted out this chapter (14th May 1999) I note with interest that the Secretary of State for Education, David Blunkett announced the Government's intention to force schools to teach a discrete course on citizenship, the nature of which has yet to be decided. My own strong view, based on sixteen years of practice is that decontextualising citizenship and trying to teach it as a discrete lesson, will suffer the same fate that PSD (Personal and Social Development) has suffered from in the four schools I have worked in. Children enjoying engaging with issues such as morality through the subjects they are taught, not being forced to do so as some form of uniform course that all children must experience.

2.2.83 My conclusive remarks on the role of values and contextuality are summed up eloquently by Olson (1993):

> "technical ways of knowing and acting do not provide the tools for analysing the moral values of technical systems."
> In: Conway (Op. Cit., p.113)

In my experience it is important when discussing circuitry design, or when using computers, to reflect upon the power and decisions that govern when and how to appropriately utilise such technologies, noting who the 'winners' and 'losers' are in such situations. The next section considers such reflective processes, noting my personal attitudes toward the extent to which reflection helps to develop the individual, in terms of their values and how the notion of humanism may be affected by technological capability.

2.2.84 **Reflection and the mind ~ that which may help to make us human within a context of technological progress**

2.2.85 My views on the place of reflection have been shaped by both my experience as a teacher of the 'design process' and also the work of Schön (1987). Prior to undertaking my Masters degree, despite having taught the importance of evaluation to countless scores of pupils, I myself had been guilty of a lack of reflection within my own professional practice. The work of Olmedo (Op. Cit., pp.247-8) acknowledges the importance of providing reflective time for teacher trainees to make sense of their environments. This further justifies Schön's observations regarding the importance of reflective practice. Kniveton (Op. Cit., p.95) illustrates the work done on memory by Edwards and Middleton (1986), suggesting that memory is often a result of social communication rather than direct experience. This clearly enhances the notion that our personal context has an effect on our mind.

2.2.86 As a human species O'Duill (1997, p.33) suggests that we are unique in having an ability to initially represent our world in the mind. It is suggested that this mental construct is then externalised by representing form, to finally create capability by actioning externally represented operations. O'Duill argues that much of education is situated in the representational phase. As a design and technology teacher I am keen to get all students operating within the actioning phase. I also see it as part of this Investigation to try and ensure that an opportunity is created for enabling due acknowledgement to be given to the philosophy underpinning such activities.

2.2.87 My technological practice, as experienced by children and students, is underpinned by values and therefore, by implicit extension, having a humanist dimension. It is my belief that technology education's unique character centres around the welding together of doing, reflecting and planning over a significant timescale, with provision built in for adjustment and modification. The reflective cerebral dimension of my subject, as experience has shown over many years, does need to be made explicit and emphasised. As such I posit that this is an area that I need to reflect upon, due to the centrality of importance I place upon my emergent view of technological capability resulting from undertaking this Research Investigation. Although unable to explore this, due to being beyond the remit of this Investigation, throughout the duration of the doctoral course I have been developing the notion of reflection as perhaps being an essential facet in helping to make us the unique human that each of us develops into.

2.2.88 **Humanism**

2.2.89 The discussion surrounding values and the human mind and memory, for myself, appear to be central to what makes us the unique individuals that we are. Our experiences and context both shape and are shaped by the fact that we operate dynamically within them.

2.2.90 In an article discussing life in Latin America, Shodjai (1994, p.7) suggests that technology is not necessarily a central issue in rural development. It is suggested that justice, socio-economics and political organisation are far more pertinent to the lives of many Southern Americans. As a result of this line of thought Shodjai suggest that technology needs to embrace complex inter-related 'techno-societal' problems.

2.2.91 This line of thought has a strong parallel with issues covered with Dr. David Kidner during the taught doctorate module on 'Ways of Seeing'. During some of these sessions we discussed the different attitudes of differing cultures toward the planet earth. For instance the Navajo Indian population of North America react collectively to decision making, regularly dance to ensure that the sun rises every day and tend to respect the planet and interact from a non-exploitative perspective. My own perspective as a 'western technologist' had been to view the world as a heap of resources to dig up and change around for the benefit of everyone. I do not acknowledge that one perspective is superior to another, merely to illustrate that on our planet there are many different interpretations to the notion of humanism and what it is to be human.

2.2.92 Barnett (1995, p.127-30) suggests that to relate technological activity to the made world totality is to acknowledge that technological change is inextricably linked to changes in the non-human natural world and what it means to be human. Barnett also draws on the ideas of Panofsky (1970) when discussing notions of humanity. It is argued that history suggests that 'renaissance humanism' was an amalgam of two separate concepts of what it is to be human. *Medieval* notions of humanity were conceptualised to be the antithesis of divinity, and Cicero's *Classical* version of humanity was in opposition to the notion of barbarism. The resulting dialectic was, it is suggested, a rational intellect with the power to create ~ ancient ideas being recycled but new things being created. Barnett (1995, p.129), suggests that the aim of neo-humanistic scholarship should be to analyse the complex inter-relationship between three aspects of the material world ~ human beings, made things and the natural world. I see an important role for design and technology educators in such a conceptualisation of what it means to be human.

2.2.93 To explore this notion of humanism it may require educationalists to pay due attention to the exploration of the effects that teaching, learning and thinking may have upon the development of technologically capable humans.

2.2.94 My participation in, and regular attendance at doctoral discussions of ontological and epistemological matters surrounding a wide range of educational issues, leads me to explore the relevance of teaching, learning and thinking as they relate to this specific Investigation.

2.3 Teaching, Learning, Thinking and Knowledge

2.3.0 The Rights of Children, Reflective Processes, Epistemic Issues, Teaching, Meta-cognition and Learning.

2.3.1 **The Rights of Children**

2.3.2 As a teacher undertaking work at doctoral level, the constant questioning has caused me to reflect at length on the roles of teaching, learning, thinking and knowledge. Clearly each of these areas is vast and beyond the scope of any number of doctoral theses. My intention of including these topics is by way of highlighting my own perceptions of each, given that my views at the start of the Ed.D. were different in a number of fundamental respects to those I now hold, stood as I am on the threshold of the 'journey's end', in the sense that the taught aspects of doctoral course ended in July 1999.

2.3.3 Bowen, in a tutorial, commented to me that:

> "the most complex ideas are most effectively expressed in the simplest language."
> Bowen (1999b)

The articulation of provoking and succinct observations have punctuated the doctoral course, through the taught modules, interactions with course members, iteratively in my own mind and through the wide range of articles I have accessed over a period of three years. Exposure to such a plethora of stimuli have had an impact upon how I view the context within which I operate. Although uncomfortable at times, I have found it refreshing and beneficial to muse over the fundamentals of my own teaching, learning, thinking and knowledge. The aim of the remainder of this chapter is to make explicit some of my own personal attitudes and influences, so that the reader can appreciate from which perspective the Investigation has metamorphosed.

2.3.4 Burgess (1986, p.67) drew attention to Karl Popper's condemnation of some aspects of education as:

> "providing unwanted answers to unasked questions."
> Popper (1959)

Waterhouse (1997, pp.20-25) suggests that all children have rights within education, e.g.:

- respect of teachers,
- worthwhile curriculum,
- not to have time wasted,
- treated fairly,
- a member of a community with adequate rule systems,
- to complain,
- choose some activities,
- participate in decision making.

An examination of fundamentals, as others in education view them, helps me to sharpen up my own practice. The vogue in recent years has been to suggest that getting pupils 'on task' is of fundamental importance to education. MacBeath (Op. Cit., p.70) contends that time off task is critical; opportunities to renew, reflect and absorb are fundamental to developing the individual. Perhaps the dialectic of the above may represent the current ideal.

2.3.5 Another paradox within education concerns knowledge and worth. On a political level the debate often appears to rage endlessly on about standards of both teaching and assessment. The annual foray into standards, at the time of publication of GCSE and 'A' levels, sees Dr.

Rhodes Boyson M.P. denouncing the hard work and efforts of pupils, students, parents and teachers as yet further evidence of society spiralling down towards yet lower standards. Observations by Learmonth (Op. Cit., p.59) and MacBeath (Op. Cit., p.69) suggesting that we should 'assess what we value instead of valuing what we can assess', for me rises eloquently above the usual standards debate.

2.3.6 My own thinking in recent years has been influenced by the notion of the development of collaborative skills within students, over time. Fielding (1994, p.411) postulates that human development is reciprocal and interactive, arguing that diversity and commonality are interdependent; individuality is a product of community, not a precursor. Quinn, Johnson & Johnson (1995, p.129) share the same perspective noting that co-operative rather than competative efforts are more effective in pupil task completion. The Secretary of State for Education in the USA, Richard Riley (1996) brings this notion right up to date by noting that the use of the 'Internet' by children encourages students to find information and collaborate in its application to the process of discovery.

2.3.7 The notion of 'tripartism' suggested by Bruner (1987, p.85) in which the processes of cognition, affectation and action although separate initially, tend to merge together over time, suggests to me that notions of uniformity or atomisation of assessment of children as unique individuals may not fruitfully match up with my conceptualisation of what it means to be effectively educated. Incorporating the dimension of experience as a time related critical factor in education is also commented upon by Sternberg (1986) in Leat (1993, p.502), noting that the development of a triarchic theory of intelligence as being concerned with the interplay between internal (mental) and external (physical) worlds and experience.

2.3.8 Children experiencing a curriculum rooted in reality is another entitlement that I personally believe all children should have access to.

This does not imply that vocationalism is 'in' and academic pathways are 'out', merely that some elements of the curriculum should provide the opportunity to relate or acknowledge the pervasive societal influences. Kay (Op. Cit., p.39) suggests that such vocational influences are rooted in historical precedents, for example Shakespeare was a jobbing writer. Weaver (1986, p.57) suggests that learning should move from the passive absorbtion of culture to the active development of creativity and communion. Concepts being developed into competence and capability. This is similar to Kimbell (1994a, p.73) suggesting that capability, in terms of progression, was like the progressive unpeeling of layers of meaning in an onion skin analogy, eventually exposing clear and unambiguous conceptual understanding that is both complex and firmly understood.

2.3.9 Linked to the notion of 'unpeeling' meaning is Vygotsky's model of 'Zone of Proximal Development' which holds that children should be exposed to tasks that enable them to work at the edge of their own understanding ~ see Hendley & Lyle (Op. Cit., p.372). The corollary of which is that such activities necessarily stretch children of all abilities. Similarly, Fielding (Op. Cit., p.410) suggests that children should be helped to 'find' learning, with a tentativeness that is bold to be brave and hesitant enough to be wise. A final influence upon my thinking about the fundamentals of education has been Bruner (1996, pp.66-67), whose use of antinomies concerning individuality and culture, talent and tool centred learning and the interplay between particularism and universality have caused me to explore at a fundamental level what I professionally do, and specifically why I do it.

2.3.10 I now turn to a recurrent theme of both this Investigation, and also of the taught doctoral programme, that of reflection. Having been a beneficiary of the reflective process, and its potential importance, reawoken within myself, I was keen to explore how this may have impacted upon the notion of 'technological capability'.

2.3.11 **Reflective Processes**

2.3.12 In training teachers to meet the challenge of educating children in a rapidly changing society, Schön (1983, p.501) suggests that educating practitioners to be reflective, instead of being simply technical rationalists is of primary importance. According to Hansen (1995, p.36) there are critical, practical and instrumental modes of reflection. *Critical* concerns ethical, moral and social criteria. *Practical* reflection concerns the explication and clarification of underlying assumptions. *Instrumental* reflection concerns how specific goals are attained. Hansen posits that, in fact, the three domains normally belong together. Hansen (Ibid., p.35) builds upon the work of Jean Piaget (1980) by suggesting that reflection is a mode of thinking in which we project mental activity to a high level, creating 'self referential thinkers'.

2.3.13 In considering the importance of reflection at a subject teacher level, Saskatchewan Education Department (1998, p.6) considers that in technology education it is desirable to make students aware of social, political and environmental factors. They also suggest that technology shapes and is shaped by society, and that citizens are a powerful influence in this respect. Bruner & Clinchy (1966, p.71) think that the pursuit of intellectual endeavour exhibits both intuitive and analytical characteristics across a majority of curriculum subjects. Also in North America, Montgomery State Education Department suggest that self-monitoring activities helps to improve the acquisition of knowledge in addition to improving generalization and the transfer of knowledge and skills.

2.3.14 For Harrison (1986) there exists a framework for individuals who wish to exercise some degree of personal choice from within the education system. Recognising and valuing past and present achievements, assessing strengths and weaknesses, producing an individual development plan, putting small parts of the plan into operation and reflecting on performance are the key steps towards self actualisation according to Harrison. I was instantly drawn to this model as it is similar to the evaluate, plan, do, evaluate 'cyclical design process' that I am so familiar with in my work with pupils and students. Kimbell (1994a, pp.69-70) defines a similar process in terms of 'task clarification'. For this it is suggested that there are two 'procedural facets'. The first is 'reflective' occurring inside the head, the second externally as an 'active' manifestation. Kimbell argues that both involve 'iteration' ~ the bouncing 'too and fro' of ideas. Tinkler (1993, p.139) uses a similar model suggesting that reflection and research lead to a spiralling up, where large ideas lead to knowledge and expertise being acquired. My own belief in the development of 'luminous familiar spots' with which students feel increasingly confident is a variation on the 'spiral curriculum' as envisaged by Jerome Bruner in the 1960s ~ see 2.3.45.

2.3.15 In musing over the importance of reflection as a practitioner I have become acutely aware of the importance that reflection (or evaluation) plays within the teaching of the problem solving process in design and technology. My work on values during my M.A. in Technology Education re-orientated me towards the importance of not seeing evaluation as a 'bolt on' extra at the end of activities. The power of discussion can be readily tapped in youngsters when discussing things that have already been made, or situations that readily exist.

2.3.16 Acknowledging the importance and centrality of reflection upon the learning process, it has caused me to question at a fundamental level what governs the nature of knowledge in any specific circumstance or subject.

2.3.17 **Epistemics**

2.3.18 Having engaged with epistemological issues across a broad spectrum of educational issues over the three years of the taught doctorate, I share the concern of Layton (1995, p.113) when he concludes that the epistemological basis of technology has seldom been given serious consideration. Custer (Op. Cit., p.225) sees this as a real challenge, to identify and clarify the dimensions of what constitutes technological knowledge. For O'Loughlin (1997, p.110) epistemological perspectives amount to coherent interpretive frameworks, there being four in number ~ '*received*', '*subjective*', '*procedural*' and '*constructivist*'. Burgess (1986, pp.63-67) notes that the Popperian view that all knowledge preferences must be justified due to all knowledge being provisional, leads to the conclusion that certainty is replaced by progress, and therefore trial and error assume a more prominent role in such a paradigm. Having seen how inadequate my own received body of knowledge, from my first degree in 1983, in the field of electronics, has proven to be due to the rapid developments in this field over the last two decades, this point is of particular poignancy at a personal level.

2.3.19 In undertaking preparatory work for this investigation ~ see Appendix 2.1, I charted the development of technological knowledge though a *trivium*, *quadrivium* and *positivist* phase to end up with a situation where faith in the notion of 'science as truth' in a modernist culture is widespread. I also developed the argument that Plato's apparent refusal to accept practical activities as knowledge, has perhaps contributed to the lack of substantive epistemological analyses of technology. Hansen and Froelich (Op. Cit., p.201) argue that academic knowledge is no longer in the ascendency, and that practical knowledge is now a powerful empowering medium.

2.3.20 Within the 'Technology For All Americans' (TFAA) movement ~ see 2.2.50, MCPS (1999, p.1) define technological knowledge as being able to: identify, use, recognise, evaluate, combine, design, present, group, assess, explore, relate, test, incorporate, brainstorm, create, invent, construct and demonstrate. Custer (Op. Cit., pp.227-239) produces many epistemic definitions of 'technology as knowledge'. These include:

the way things work (huge cognitive base), a broad range of knowledge from tacit to analytic/symbolic, praxeological in the medicine/dentistry sense, knowledge as 'accumulated practice', and finally an acknowledgement that technological knowledge is necessary but insufficient in isolation for technological activity.

2.3.21 A balance between 'propositional' knowledge (knowing that, explicit, advice, procedures and rules) and 'action' knowledge (knowing how, tacit, non-verbal and know but can't tell) is how technology becomes distinctive from science, according to Hansen and Froelich (Op. Cit., p.196). Satchwell and Duggar (1996, pp.1-2) acknowledge the importance of the human and societal dimensions as being central to any technological body of knowledge. They posit that the amalgamation of several fields of knowledge to solve practical problems lies at the heart of quality technological activity. Perry and Danos-Elder (1997, p.135) also suggests that knowledge acquisition processes are embedded within a social context. This also aligns itself with the post-modernist notion of Foucault ~ see Waks (1994, p.45), that suggests forms of knowledge are components in the development and extension of regimes of social power.

2.3.22 My engagement with epistemics during the taught elements of the doctorate led me to acknowledge the importance they would play in trying to move towards a clear definition of 'technological capability'. Section 3.2 of the next chapter acknowledges the importance of considering such a dimension. I believe that a meaningful definition would be impossible without an epistemic dimension.

2.3.23 This section has highlighted the importance of students being able to balance different types of knowledge, with the role of the teacher being central in this respect. The next section will probe the notion of 'teaching', as it may impact upon this specific Investigation, and as a result of my evolving perception as it emerges from my doctoral reflections.

2.3.24 Teaching

2.3.25 Teachers of the future, according to Luke (Op. Cit., p.17), can be described as 'infonauts', networked and ranging over a vast terrain, with little possibility of being able to operate effectively in isolation. For Newby (1996, p.44) it is important that teachers show a passion for life and express this through sharing a richness of experience with young people, a sentiment and dictum that I find myself in complete agreement with. Barrow (1995, p.9) suggests that the way we talk is 'isomorphic' ~ it mirrors what we believe. Experienced teachers, according to Preece (1994, p.49) combine practice that enhances both pupil achievement and pupil attitudes. In the same article it is argued that 'General Pedagogical Knowledge' can be defined, so that it is possible to make explicit principles and strategies of classroom management that transcend subject matter (Ibid., p.42). Bruner and Clinchy (1966, p.71) describe a 'romantic pedagogue' as regarding the aim of education to preserve the intuitive gift'. The 'foolish pedagogue' they regard as wishing to get behind all intuitive activity. A pragmatic thought is offered by Fielding (Op. Cit., p.393) who suggests that a teacher must strike a balance between *student entitlement* and *institutional necessity*. Echoing this, my own experience has been one of trying to make sure that in such a situation due attention is paid to the former.

2.3.26 To help a teacher develop each student to their full potential, Stephenson (1993c, pp.6-7) suggests they must be aware of which 'primary needs' the student wants addressed. He categorises students as being one of the following: *earners* of respect, *provers* of value, *takers* of qualifications, *searchers* of identity or *builders* of commitment. Once discovered, it is argued that an acceptance that all categories can benefit from independent study coupled with strong student motivation to learn leads to effective teaching. Bruner (1966, p.201) describes this as 'optimisation of learning', where the teacher matches the learning materials to the style of the learner. Moving into procedural activities within the classroom/workshop, McCormick, Murphy and Hennessy (1994, p.32) argue that teachers <u>must</u> make processes, rationale and criteria explicit to the pupils, a feature that my practice confirms as being highly desirable. Although logic and method are noted as being important by Shield (Op. Cit., p.7), so are knowledge and skill. Core knowledge must be made explicit and structured, subsequently being taught in a structured way. Whilst tentatively endorsing this, I must clarify that 'taught in a structured way' means in a coherent manner, rather than bearing notions of atomisation. To do this it is suggested that technology must divest some of its knowledge claims ~ see Appendix 2.3.

2.3.27 Harris, Wallace and Ruddock (1995, p.257) suggest there are four main ways of approaching teaching: *traditional didactic transmission*, *engaging students experientially*, by a *creative approach* and also by a *task based learning programme.* As a practitioner I have made use of all four methods in a variety of situations. I was interested in extending this analysis of teaching methodology, and note that Montgomery (1993, p.65) identifies four 'key elements' to good teaching. These being: a *motivational context* in which motivation is intrinsic, the *learner being active* as opposed to passive, *interaction with others* to discuss ideas that occur and a *well structured knowledge base* is evident and displayed.

2.3.28 Specifically regarding the teaching of design and technology, I note that Cowan (1998, p.5) suggests that teaching the design process is 'good fun'. This matches my own experiences over the past fifteen years. Kozolanka and Olson (1994, p.215) see the primacy of teaching design and technology as having the ability to engender resourcefulness in students. Butcher (1993, p.189) sees the role of the teacher as being one of devising learning processes that allow students to manage time, work as a team, communicate, solve problems and attain academic excellence. Shield (Op. Cit., p.5) echoes this by suggesting the need to structure the teaching of 'process'. For example: how to draw 'appropriate' conclusions, task motivation, consensus as product of negotiation and forming networks of shared belief and opinion. Butcher (Op. Cit., p.191) proposes that a framework for the delivery of capability would include self-awareness, opportunity awareness, decision learning and transitional learning.

2.3.29 Focusing down and reflecting upon what it means to teach 'A' level Design and Technology, I was interested to read an article by Taylor, Reid and Holley (1974, p.195). They suggest that VI forms are still based on the notion of classical and scientific scholarships, notions left over from Victorian times. Such models do not bustle with technological capability. It is my own belief that as we enter the next millennium perhaps what is required is a paradigm shift that sees the education system in England and Wales embrace 'vocationalism' in its widest sense (e.g. As envisaged by the HEC (Higher Education for Capability movement) through Stephenson (1994b)), as having genuine unqualified parity of esteem with traditional academic pathways. Such a paradigm shift would also allow for Vygotsky's notion of 'Zone of Proximal Development' ~ see 2.3.9, to become more widespread, in a climate of education that has, by necessity, to respond to ever more rapid change. A warning here is contained in Bruner and Clinchy (Op. Cit., p.76), who note that unexploited intuition without direction doesn't bring a person to realise their full potential.

2.3.30 Bruner (1969, p.52) developed this idea into a 'spiral curriculum' where material is translated into logical forms that are challenging enough to cause pupils to advance at different ages. Bruner suggested that, within the bounds of reason, if it was worth knowing as an adult then it was worth knowing as a child. Kimbell (1994a, p.72) specifically discussing Design and Technology teaching suggests that whether 6, 12 or 16 years of age capability is about understanding, responding, making and evaluating. Implicit in this notion is the idea of children being aware of, and consciously able to affect their own thought processes to develop their design and technological capability. This leads into the next section's discussion on the potential role of meta-cognition, and how it might impact upon the acquisition of' technological capability'.

2.3.31 Teaching for myself has never been a simple mechanical process of imparting knowledge and filling up 'empty vessels'. Developing the whole dynamic, complex child by encouraging both individuality and teamwork through pastoral, curriculum and extra-curricular activities is central to my teaching philosophy and methodologies. Given this view, I believe it is important to explicitly acknowledge this interpretation of 'teaching', an interpretation that will inevitably have a bearing upon my understanding of technological capability. As capability is, in part, about being proactive, how I encourage volition within students will inevitably colour my notion of what it is to be technologically capable or to encourage others to become so.

2.3.32 **Meta-cognition**

2.3.33 In addressing thinking, as is relates specifically to this Investigation, one aspect I have striven for in my teaching of problem solving or the design process is thinking efficiently, or managing to sift out the important from the trivial. At 'A' level, the six hour design exam, counting for 33% of their final result, aims to get students to explore problems, quickly prioritise salient points and then propose a number of solutions all related to a specification. Bruner and Clinchy (Op. Cit., p.81) cite such efficient thinking as 'heuristic economy'. Montgomery (1995) notes that in further education, one of the Capability (HEFC) movement's main aims is to turn students into 'self starters', claiming that history shows that education for the masses has meant lower order didactics and lower order thinking whilst paradoxically the political speak is of raising standards and instilling disciplines of subjects, thoughts and actions. In England and Wales, Kay (Op. Cit., p.39) observes that the National Curriculum appears to restrict 'free' thought in pupils and students.

2.3.34 In looking at 'critical thinking' and the teaching of reasoning, Girle (Op. Cit., p.51) suggests that the use of dialogue is important. A context specific model called 'dialogue logic' has five general foci, these being: making assertions, giving & evaluating reasons, asking & answering questions, explaining and withdrawing assertions and changing commitments. The problem of assuming that thinking can be generically transferable is noted by Jewell (1991, p.79), raising questions as to whether the learning of formal logic necessarily improves reasoning skills. Ennis (1991, p.31), building on the work of John Dewey (1933) unpacks the concept of scientific thinking, positing that there is a thirteen 'activity' model to get from research question to communicating findings. My own view is that such a model describes mechanistically what problem solving is without actually capturing the essence of those 'Eureka' (or flash of inspiration /connectivity) moments that teachers often observe students make as they articulate their thinking. The ready association professionals, myself included, make between the interplay of mathematics, science and technology needs careful consideration. For instance Burghes, Price and Twyford (1996, p.41) in looking at the subjects of design and technology and mathematics argue that broadly mathematics is 'conceptual', whereas design and technology is, in general terms, 'procedural'. My own experience reveals mathematics to be about number patterns and relationships, therefore by implication conceptual.

2.3.35 Making students aware of their own thought processes, and the importance of considering the purpose of learning according to Harris, Wallace and Ruddock (Op. Cit., p.254) constitutes the 'executive process' of meta-cognition. Transferability within an experiential framework is how Leat (Op. Cit., p.508) views the same concept. Solomon and Hall (Op. Cit., p.270) suggest that meta-cognition involves learning by comparison between recent accomplishment and that from earlier times. A kind of testing of fundamentals to make performance better. With specific reference to design and technological education, Stables (Op. Cit., p.166) suggests that children operate at either a 'tacit' level or attain a rich meta-cognitive understanding of processes they are using. Montgomery (1993, p.68) suggests that a formal part of teacher education should provide guidance towards helping tap into meta-cognitive events that allows people to become 'able learners'. In considering the whole field, Bruner (1987, p.91) highlights the importance of context by postulating that the notion of meta-cognition varies according to one's cultural background. This is a theme that came through strongly in the taught elements of the doctoral when looking at how different cultures related to earth ~ see 2.2.91. Adey's (1997, p.386) view, that controlled cognitive conflict, encouraging meta-cognitive reflection on one's own thinking was, on a personal level, written confirmation of one of the facets of what ostensibly work at a doctoral level constituted.

2.3.36 Although I found much to agree with in the above, regarding meta-cognition, I noted with caution that Adey (Op. Cit., p.380) suggests the field of cognitive psychology is divided over the issue of the generalizability of cognitive capability. Bruner (1966, p.3) is less skeptical, suggesting that there exist 'persistent styles in the mind' such as manipulation, imagery and symbolism that people employ over a range of situations. O'Duill (Op. Cit., pp. 30-31) suggests that the human mind has three phases of development: *'sensorimotor', 'operational'* and *'logiostic'* (typifying learning in the context of a medium that can route its own messages). From my work as an undergraduate I was drawn to the strong parallels there appear to be between the work of Jean Piaget on cognitive thinking and the O'Duill model. I find the notion of *'logiostics'* interesting and see this as an avenue to explore when my current Investigation has been completed.

2.3.37 Having become increasingly aware of the power that meta-cognition has appeared to give me in terms of both professional practice and efficacy as a middle manager, I am convinced that broaching such issues with students in school could prove to be equally fruitful. This however remains beyond the remit of this Investigation and, as such, will be an avenue to explore subsequently.

PERSONAL CONSTRUCT THEORY

2.3.38 Another notion connected with the link between learning and thinking that I have been aware of is the existence of Personal Construct Theory, as envisioned by Kelly in 1955. In acknowledging the centrality of context and individuality, by concept mapping based on cognitive and constructivist psychology, the theory is one that I have increasingly, over the past three years, used to inform my own curriculum planning. I have done so by basing my thinking on the psychological unit of the 'concept', making explicit its use to the students that I teach. A cautionary tone is observed by McCormick, Murphy and Hennessey (Op. Cit., p.7) when looking at the work of Bruner (1986) as a critique of social constructivism. The notion of children 'discovering' and developing procedural understanding as a result of problem solving is, according to McCormick (et al) (Op. Cit.) now widely discredited. The provision of problem solving contexts on their own will not necessarily ensure effective thinking takes place.

THE CRITICAL THINKING MOVEMENT

2.3.39 Siegel (1991, pp.18-30) identifies three components of *'Critical Thinking'*. Firstly an '*ability'* concerning skills and criteria of reason assessment. Secondly that there is an underlying *'epistemology'* to critical thinking. Finally that a *'critical spirit'* exists which is a matrix of dispositions, attitudes, habits of mind and character traits. An analysis of the debate on 'critical thinking', and the extent to which it may be possible to generalize, as observed by Hager (1994b, pp.58-59) reveals positions adopted by *'generalists'* like Ennis (1987), suggesting that critical thinking is largely generalizable, whilst *'specifists'* such as McPeck (1990) believe that such thinking is discipline specific. Others who engage with the debate, but avoid polemics, include Siegel (Op. Cit., p.24), who thinks that *'epistemology'* and *'critical spirit'* are both generalizable, thereby making most, but not all facets of critical thinking, transferable. When viewed as a 'hermeneutic circle' Siegler (1997, pp.324-328) contends that issues like pervasiveness of variability, goals as constraints on learning and bi-directional (interactive/dynamic) influences of performance and conceptual understanding make critical thinking something that extends beyond a series of generic competencies. Appleberry (Op. Cit., p.4) suggests that whether generalizable or not, with the increasing modularisation of H.E. courses a counter trend may be to hone critical thinking skills in each subject so that each student discerns a commonality running through their courses, Personal experience leads me to observe that this increase in modularisation is becoming more prevalent at 'A' level also. As with the debate on personal construct theory, and its relationship to the teaching of design and technology, critical thinking is also a model that I would wish to explore and reflect upon in greater depth when I have completed this Investigation.

2.3.40 As with my professional practice , I like to try and synthesise my engagement with the notion of thinking down to a concrete level which I, as practitioner, might usefully capitalise upon with the aim of improving my own practice. A 'thinking curriculum', according to Hall (1995, p.51) is one in which principles are understood, knowledge and skills are applied to new situations, complex ideas can be investigated and analysed. Such a curriculum, according to Hall, would have an enduring value, be versatile, be retained longer, be intrinsically motivating and develop a more positive attitude in people. Regarding thinking when using the design process, Johnsey (1995, p.214) suggests linearity is not universal, neither is the practice of addressing human needs, nor proceeding in an orderly way. Reiteration, spiralling back, and incrementally creating change with occasional flashes of inspiration are closer to the truth rather than a neatly laid out sequentially smooth process are the result of Johnsey's field observations. Practice over the past two decades, both in guiding pupils, and from a personal perspective reveal this to resonate strongly with my own perception. This latter observation leads on to a consideration of learning, as it relates to technological capability and design and technological activity.

2.3.41 Whether through the theories of Critical Thinking, Personal Construct Theory or other theories associated with cognition, I have realised the power meta-cognition holds for heuristics and economy of thought. I now believe meta-cognition to be a dimension of education that students must possess to be technologically capable.

2.3.42 **Learning**

2.3.43 My intention in looking at 'learning', as it impacts upon this Investigation, is to clarify emergent issues as they have surfaced during my literature review. There is no intention to provide definitive commentary on any aspect of such a complex subject, merely to contextualise my thinking, as impacted upon by this investigation and the taught doctorate, at this specific point in time. Due emphasis must be given to chronology, as the requirement of the Ed.D. is to undertake an Investigation that has a strong developmental flavour. In this spirit I look at precursors to learning, models and learning cycles, a consideration of experiential learning, learner managed learning and what might constitute learning outcomes.

2.3.44 Precursors to learning, or predispositions as identified by Bruner (1966, p.3) are essential for effective learning and problem solving. Hall (Op. Cit., p.57) targets the policy makers, urging informed recognition of what important learning is and recognition of how learning actually occurs. Recent publications such as the DFEE (1999) green paper on 'Meeting The Challenge of Change' (performance related pay), would lead me to suggest that at a macro-political level there is some ground to be covered before such a goal would be deemed to be attainable. The required paradigm shift from teacher and taught to students and learning, as envisaged by Luke (Op. Cit., p.16) may provide one possibility, providing, as Luke notes, teachers are freed from 'batch processing' large numbers of pupils and they let go of some 'cherished tenets'. Weaver (1986, p.57) suggests that an important factor concerning learning depends on the strength and direction of propelling needs and motives. The work of Sotto (1994) as cited in Hendley and Lyle (Op. Cit., p.373) posits that the brain both takes in and processes information, thereby implicitly acknowledgement that learning is participative. Montgomery (1993, p.60) provides interesting analysis on learning modes suggesting that we remember:

- 10% of what we read
- 20% of what we hear
- 30% of what we see
- 50% of what we see and hear
- 80% of what we say

and

- 90% of what we say and do at the same time

As an educator this article has proven to be both enlightening and also influential in how I approach teaching and learning styles when completing curriculum reviews.

CYCLICAL MODELS OF LEARNING

2.3.45 According to Bruner (1966, pp.140-142 & 202 and 1969, p.13) knowledge without structure is easily forgotten. His 'spiral curriculum' allows children to see issues over time, and allows teachers who are developing a curriculum to revisit basic ideas repeatedly, layering skills in progressive complexity. Building upon the work of the Kolb (1984) 'experimental learning cycle' Montgomery (Op. Cit., pp.63-64) developed a 'cognitive-process learning spiral' (Fig. 2.1):

Cognitive Process Learning Cycle (Montgomery)

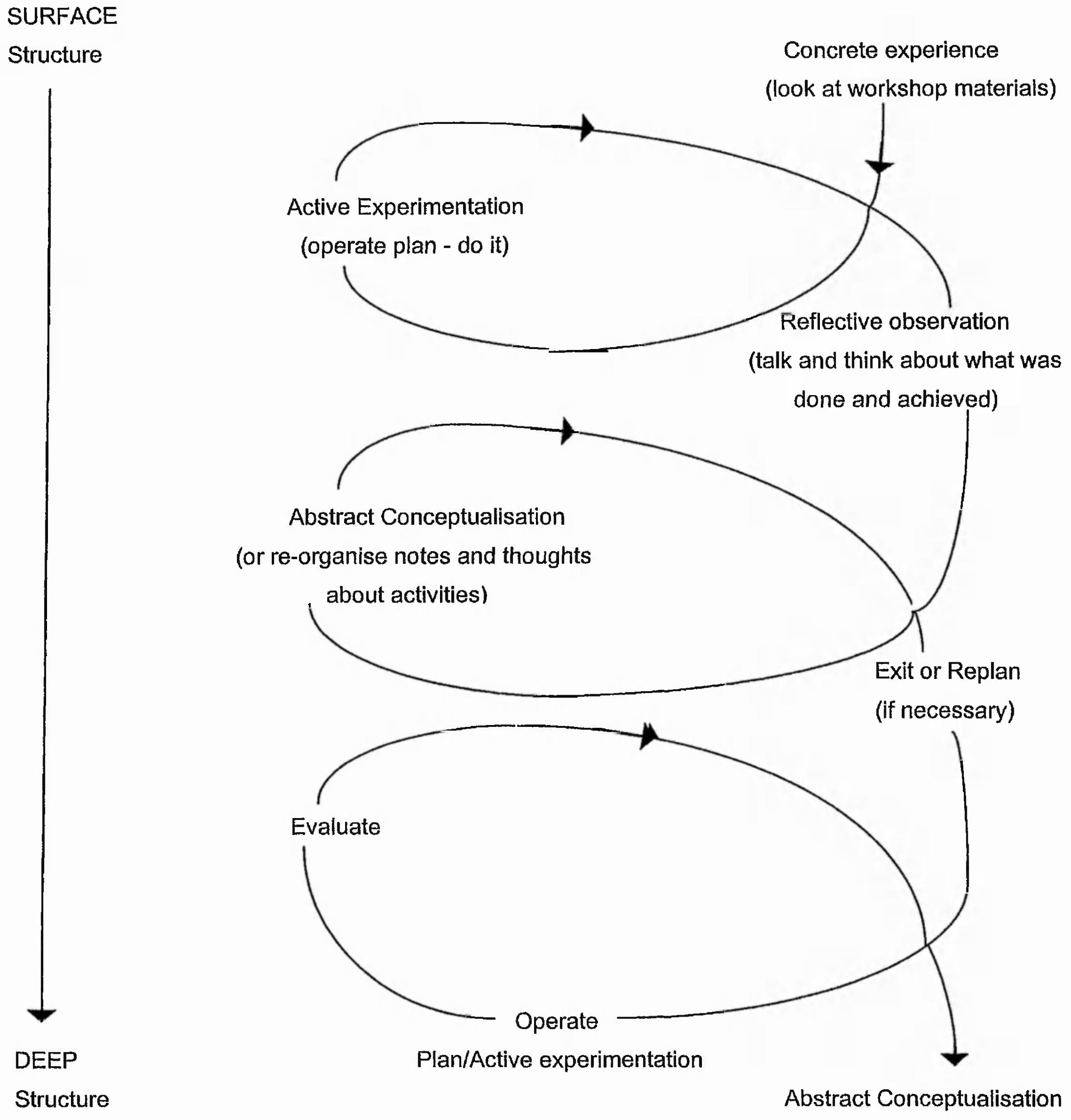


Figure 2.1

2.3.46 For an analysis of the original Kolb learning cycle see Laycock (1993, p.32). Although cyclical (or spiral) models tend to prevail when discussing learning, Fielding (Op. Cit., p.407) has developed a model that has at its centre a 'learning magnet' around which momentum for learning is generated. The constituent facets of the 'magnet' are: *personal identity, student purposes, teacher as learning partner, teacher as enthusiast, other people, physical environment, learning styles* and *student as learner.* I noted the importance of both the context and the teacher in this particular model. The Saskatchewan Education Department (1998, p.6) cite the 'decision tree' of Patrick and Remy (1987) as central to the development of technological education. The 'tree' has four steps: '*discover*' the need for a decision, '*explore*' associated values and goals, '*develop*' alternative actions and '*predict*' consequences. Over a period of time students should be encouraged to recognise gradual learning as real learning. An influential article on learning models was provided by Fielding (Op. Cit., p.394) in summarising the work of Wilkin (1997), Pask (1976) and Hudson (1996). Fielding suggests that history reveals that the science/art schism is rooted in learning styles, as well as in subject content. It is postulated that the following characteristics are discernible:

- Sciences ~ Field Independent (tight), Serialist and Convergent
- Arts ~ Field Dependent (loose), Holist and Divergent

As with the work on learning and thinking these models have provided me with a clearer insight into the processes of learning, and have already informed my practice at both the curriculum planning and 'delivery' stages. It is clearly beyond the scope of this Investigation to pursue this further, leaving this as another avenue to hopefully be explored upon completion of my current research.

EXPERIENCE AS A DIMENSION OF LEARNING

2.3.47 One of my beliefs prior to undertaking study at doctoral level was that technology education was rooted in experience. Henry (1993, p.107) divides experiential learning into seven types: *problem based, activity based, personal development, project work, prior learning, independent learning, placement based and action learning.* Henry (Ibid. p.107) further contends that each approach has different *concerns, processes, methods and outcomes* associated with it, for example:

Approach	Concern	Process	Method	Outcome
Project work	Autonomy	Responsibility	Presentation	Capable
Personal development	Application	Respect	Practical	Competent
Prior learning	Acceptance	Reason	Portfolio	Credible
Placement based	Affective	Reflective	Peers	Confident

Figure 2.2

For example, if experience is to be gained through a placement, the concern is to affect in an individual the ability to perform, learning by a process of reflection within a peer group, hopefully inducing confidence in the individual.

2.3.48 With specific reference to the learning of craft skills, Solomon and Hall (Op. Cit., p.269) take the thoughts of Polanyi (1958) on 'in dwelling' to suggest that imbibing through doing until the tool becomes an extension of the body was how traditional craft skills were passed down via 'guilds' in an evolutionary process. Although the title, 'epistemology' and pace of developments have changed, the fundamental notions that building things motivates people, and inductive and deductive processes aid learning, as discussed by Hansen and Froelich (Op. Cit., p.199) appear to myself, as teacher/researcher, to continue to assume a primacy of importance.

2.3.49 In Montgomery County Public Schools (1999, p.1) Technology Education is defined as process oriented, centered on students learning how to learn and how to process information. Zuga and Bjorkqvist (1989, p.1) suggest that the learned ability to develop ideas and create solutions will always serve the learner. Cowan (Op. Cit.) suggests that having an intimate understanding of materials allows a designer to model harmonious relationships that lead to knowledge being related to products in a natural and harmonious way. In some respects mirroring the William Morris adage of only having things in one's house that are known to be useful or believed to be beautiful ~ see Appendix 2.2. Gradwell (Op. Cit., p.266) cites the *'Iconic Mode'* of Bruner (1987) as action learnt, wordlessly followed by being embedded into concept formation. In this '*emergence*' model early sensory-motor actions help to develop images that have autonomous status, a type of '*summariser of action*', which combines spatial ability with doing. For McCormick, Murphy and Hennessey (Op. Cit., p.21) the recognition of this interplay between '*conceptual*' and '*procedural*' knowledge is fundamental.

LEARNER MANAGED LEARNING

2.3.50 Regarding 'Learner Managed Learning' Meyer (1977), notes that:

> "As agents in social institutions, teachers have chartered goals and methods, while learners have expectations shaping their subjective understandings and actions - they are not "matter" to be shaped. On the contrary, what learners, shaped by institutional factors, *do* is the main determinant of what is learned. The learner's commitment and engagement determine whether *any* intended learning takes place."
> Waks (1994, p.42)

A similar observation is made by Montgomery (1993, p.59) suggesting that learning 'goes beyond givenness', especially if capability is concerned with turning learners into self starters. Higgs (1933, p.125) suggests that a highly competent self starter is:

- ready for autonomous learning

- self-reliant
- in possession of attitudes of responsibility
- purposive, independent and interdependent
- oriented towards learning tasks
- productive and willing to share power
- an effective user of cognitive strategies (meta-cognition)
- self-aware

and

- self-evaluative

2.3.51 According to Montgomery (1993, p.67) certain cognitive study skills are relevant to learner managed learning. A non-exhaustive list includes:

- locating the main and subordinate points
- flow charting
- labelling
- deletion
- categorising
- tabulating
- comparing
- sequencing
- contrasting
- classifying
- drafting and redrafting
- diagramming
- critical appreciation

and

- identification of intent, bias, attitude, tone and propaganda.

2.3.52 Fanning (Op. Cit., p.3) quotes Dewey (1960) as regarding autonomous and responsible initiative to be natural, essential and learned. Higgs (Op. Cit., p.125) describes the level of readiness and ability of learners to deal with the demands of specific learning tasks at given times as '*learner task maturity*'. How to orientate students towards 'learner managed learning' is broached by Laycock, Op. Cit., p.29) under the title 'A Charter for Androgogy':

- progressively decrease the learners dependency on the educator
- help the learner discern how to use learning resources
- assist the learner to assess his/her learning needs
- assist learners to assume increasing responsibility for defining learning objectives, planning their own programme and assessing their progress
- organise what is to be learned
- foster learner decision making
- encourage the use of criteria for judging
- foster a self-corrective, reflexive approach to learning
- facilitate problem posing and problem-solving
- reinforce the self-concept of the learner as a learner
- emphasise experiential, participative and projective instructional methods

and

- make a moral distinction between helping the learner understand a range of choices, how to improve the quality of choosing versus encouraging the learner to make a specific choice.

2.3.53 For Horton (1993, p.204) the 'Capable Learner': manages the learning experience, responds to challenge, is innovative, builds relationships, makes learning count and puts a value on learning. Fanning (Op. Cit., p.4) echoes this, noting in addition that the autonomous and responsible initiative needed for success centres on collaboration, dialogue and information sharing, doubting that these skills are rarely practised in most schools.

2.3.54 Prior to recent impositions of literacy and numeracy hours, breaking the Dearing moratorium on curriculum change before September 2000, in primary education, Waterhouse (1997, p.21) contends that life isn't compartmentalised and problem-solving teaches co-operation. At the other end of compulsory education Newfoundland and Labradour Department of Education suggest there are six 'Essential Graduate Learnings' that all students should leave school with: aesthetic expressions, citizenship, communication, problem-solving, technological competence and spiritual and moral development. This makes a refreshing and laudable change from the climate within which the National Curriculum for England and Wales has been developed. Such a model does not degenerate into arguments over minute divisions of time for subjects, or which particular subjects should assume prime importance by virtue of labels such as 'core' or 'foundation'. As a teacher/researcher reviewing models, outcomes and precursors to learning has been both informative to this Investigation and to my professional practice. If capability is to be managed for, and developed in, students, I am of the opinion that a model which allows for cyclical recurrence or iteration is central to the notion of effective learning.

2.4 Conclusive Remarks

2.4.1 Having drawn together many of the contextual influences that impact upon my professional practice, my doctoral work and my personal values, in Chapter 3 I will explore the notion of technological capability as it impacts upon this specific Research Investigation, against the contextual backdrop as explored within this chapter.

2.5 Reflective Remarks

2.5.1 Taking the time to review the development of D&T over the last decade was personally both interesting and informative to myself as a practitioner

2.5.2 This chapter enabled me to see the centrality that context plays at many levels of the learning process to both students and to myself as a teacher.

2.5.3 Clarifying terms allowed for clarification of thoughts and also to a feeling of 'reflective sharpness'.

2.5.4 The relationship that technology has with society became a prominent theme within my Investigation ~ acknowledged in the exploration of industry, culture and values in this chapter.

2.5.5 Both the taught modules and this Investigation have made me aware of the interplay between action and reflective thought.

2.5.6 Epistemological and ontological questions have been raised and explored, concerning technology and technology education.

2.5.7 As an aspirant Senior Manager I have come to appreciate the interplay between *student entitlement* and *institutional necessity*.

2.5.8 In undertaking this research I have become far more aware of my own thought processes. I see a real benefit in working on meta-cognition with the students I teach.

2.5.9 Learning cycles and iterative oscillatory models appear to culminate in the goal of 'learner-managed learning'.

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

CHAPTER 3

TECHNOLOGICAL CAPABILITY

"ONE CANNOT BUILD LIFE FROM REFRIGERATORS, POLITICS, CREDIT STATEMENTS AND CROSSWORD PUZZLES. THAT IS IMPOSSIBLE. NOR CAN ONE EXIST FOR ANY LENGTH OF TIME WITHOUT POETRY, WITHOUT COLOUR, WITHOUT LOVE"

ANTOINE DE SAINT-EXUPÉRY

1999 KEITH ATKINSON

3.0 Capability

3.0.1 Chapter 2 and Appendix 2 ~ 2.1, 2.2 and 2.3, located my beliefs and practice in context, making explicit the values framework within which I operate as a teacher researcher. It also highlighted some pertinent evolutionary aspects of the subject of design and technology from a deliberately personal perspective. My own navigation (see Appendix 2 ~ 2.2 and 2.3) was charted through the imposition of the National Curriculum in Technology, subsequently to be reintroduced as 'Dearing' Design and Technology, via a process that involved far greater teacher consultation.

3.0.2 Big 'emergent' issues of teaching, thinking, learning and knowledge were explored, only as I perceived them to impact upon this Investigation. This, I thought necessary, due to the constant raising of issues connected with each one being encountered during the literature search and across the three years of the Ed.D. 'taught modules'. Eventually these issues crystallised into themes I felt unable to leave as avenues to explore at a later date. I deemed them too important to put to one side. Personal reflection, having committed my thoughts to paper, leads me to suggest that they have informed both the writing up of the Investigation and also Cycle 2 of my Action Research.

3.0.3 As my research question involves an analysis of technological capability within two specific contexts, Chapter 3 is initially concerned with the etymology of technology in general terms. The chapter then focuses down on an epistemology of technology, to include an international perspective. This will make explicit cultural differences in the use of the phrases 'technological literacy' and 'technological capability'. The latter is explored in some detail as it gets to the heart of both my research question and, of equal importance to me as a practitioner, to what I teach and why I teach it.

3.0.4 The emphasis for the rest of the chapter focuses in on education, to look at characteristics of the teaching of design and technology, and several models of exactly what is meant by technology education. Issues of leadership and meeting the challenge of change draw the chapter to a close, and set the scene for a discussion of methodology and research analysis.

3.0.5 The aims of this Chapter are:

- To provide a broad analysis of the term technology, necessarily making use of International dimensions that incorporate various cultural perspectives.

- To explore in detail the notion of Technological Capability (Technological Literacy in the USA ~ with a difference in emphasis) as applied outside and within the field of education.

- To make explicit those feature of teaching 'A' Level Design and Technology that provide the purposes, characteristics and mission of the subject; what is perhaps often defensively referred to as the 'uniqueness' of one's own subject.

- To explore a number of models of technology education and explore the inter-relationships between them. In Chapter 6 I clarify what technological capability means to me as a teacher researcher as I approach the end of a three year doctoral journey ~ see 'Working Definition of Technological Capability' in 6.4.3

- To explore skills issues within leadership of education, as paralleled in the acquisition of technological capability.

- To provide a reflective analysis on the place and challenge of change within my professional context, as a fusion between my work as practitioner and my doctoral studies as a researcher.

3.1 Use of Texts and Taxonomies

3.1.1 In considering 'technological capability' as referred to in educational circles within England and Wales, the closest parallel within American (USA) education circles is 'technological literacy'. The former being largely process driven, the latter being mainly content driven. (For a detailed discussion of each ~ see sections 3.4 and 3.5.) In analysing the word technology I have spent time analysing textual descriptions, and the use of taxonomies in concept definition.

TECHNOLOGY

3.1.2 When approaching the word 'technology', which has assumed a wide variety of meanings in everyday language, I have found such an approach (word analysis) an aide to etymological and conceptual clarification. This section will move from a definition of literacy via, categories of literacy, capability and language, intertextuality, things as texts and a lexicon of literacy, to the development of a taxonomy of literacy that emphasises the key aspects of awareness and understanding.

LITERACY

3.1.3 Literacy, as defined by McDowell (1998, p.1), is the ability to encode and decode a message. Barnett (1995, p.119) posits that 'categories of literacy' deserve to perish if they don't mean more than competence in some form of culturally significant behaviour. The notion of capability appears to be central to Barnett's thinking. When looking at this idea of the interplay between capability and language, Medway (1994, p.91) defines two 'macro functions' of the purposive use of language. *'Ideational'* function refers to concepts being communicated, whilst *'Interpersonal'* refers to the ability to relate to others. As a technology teacher I have long cited the need to be an effective communicator as one of the core reasons for studying design and technology, particularly though not exclusively at 'A' level.

3.1.4 The process of one text quoting another by echo or 'explicit citation' is called *'Intertextuality'* and is used, according to Medway (Ibid., p.92), to convince readers or construct arguments. The interesting use of 'text as things', for example, the use of the word 'deconstruction' to imply some sort of physical presence, might allow for the use of 'read' and 'write' to be used to effect in the 'made' world. This, Barnett (1995, pp.122-123) suggests, is what Latour (1992) refers to as the *'sociology of artefacts'*, in which 'artefacts' and 'social roles' are conceptualised in terms of 'scripts' and 'actors'. Artefacts are likened to 'implicit' scripts and 'non-human' actors. A major personal influence in this whole area of the 'sociology of things' has been the work of MacKenzie and Wajcman (1985).

3.1.5 In attempting to provide a lexicon to encapsulate what it may mean to be 'literate' in a technological sense Wright (Op. Cit., p.5) offers up four categories of command verbs:

- Literal ~ define, diagram, enumerate, identify, list, outline, state
- Application ~ describe, discuss, explain, illustrate, outline, prove, summarise, trace
- Integration ~ compare, contrast, justify, review
- Evaluation ~ criticise, evaluate, interpret

In operating at this level, of trying to ascertain the essence of what it is to be technological, or what technology is, the organisation and interplay of particular verbs, where each subject on the school curriculum may use common verbs, but in unique combinations, may go some way to capturing the 'uniqueness' of what each subject is about. In Chapter 2 ~ see sections 2.2.77 and 2.2.88, I highlighted the importance of values and humanist dimensions, suggesting that for me personally I felt unable to teach what I regarded as a meaningful technological curriculum without these two areas being placed at the heart of my 'delivery'.

3.1.6 A final interesting thought, building upon the notion of unique uses of combinations of verbs to provide the essential uniqueness of subjects, Wright (Ibid, p.2) cites a taxonomy devised by Todd et al (1985) to show a hierarchical progression from a state of awareness to criticism.

SUPERFICIAL Level			
	Awareness	Know That	Understanding
	Literacy	Know How	Comprehension
	Ability	Know That & How	Application
	Creativity	Know That & How	Innovation
	Criticism	Know That, How & Why	Judgement
DEEP Level			

I have found the work of Wright both informative and engaging and has led me to this conceptualisation of uniqueness in terms of 'unique combinations' and emphases of command verbs, something of a 'Eureka moment' in my personal development as a teacher researcher. Broadening my thoughts on texts out, I now consider the 'nature' of technological knowledge.

3.2 Epistemology of Technology

3.2.1 Langdon Winner (1977) is cited by Barnett (1995, p.121) as describing Technology as a word whose time has come, but noting that the nature of human creation has emerged as a source of genuine perplexity, partly due to the fact that artefacts continue to increase in complexity and opacity. Nelson (1998a, p.1) gets to the heart of the paradox by suggesting that to many technology is mysterious, magical even omnipotent, yet most know little about it thereby being limited as citizens to make informed decisions about it.

3.2.2 Hansen and Froelich (Op. Cit., pp.180-182) define technology in terms of 'etymology', 'social phenomena' and 'first hand experience'. In Chapter 2 I undertook an etymological discussion of the word technology ~ see Appendix 2.1. Regarding 'Social Phenomena' it is suggested that an exploration of 'methods' deployed, and the determination of 'residue' that resultant products and services create, would provide a conceptualisation of the nature and role of technology in the late twentieth century, thereby creating clarity regarding its very essence and knowledge range. The thinking behind the notion of 'First Hand Experience' originates back to 'craft guilds' where skill acquisition over a period of time is a pre-requisite to being deemed as being competent. In Canada teachers of technology are required to have worked in industry for five years before entering the teaching profession.

3.2.3 I also noted in Appendix 2.1 the historical impact that Plato had on the subsequent conceptualisation of technology in his valuing of theory more than practical. I share the concern expressed by Cosgrove and Schaverien (Op. Cit., p.1) that technology often appears rent by bipolar approaches that tend to emphasise either technical utilitarianism or academic rationalism. Radaburgh (Op. Cit., p.1) suggests that technological knowledge should be seen as a fusion between three areas: '*descriptive*' facts, '*prescriptive*' facets such as process improvement and quality efficiency and '*tacit*' understanding that is implicit, being embedded in activity. Such analyses align themselves with the thoughts of Schön (1996, p.2) who suggests that in many subject areas there are many different strands and modes of knowledge that require linking together. Such a process is seen by Schön as the essence of engineering capability.

3.2.4 A personally influential television series, and subsequent book, that I was exposed to in the mid-seventies was the work of Bronowski (1973) on the series 'The Ascent of Man'. The notion of 'Homo Faber', or human as maker, instead of 'Homo Sapien' or human as thinker shaped my fascination for technology, an intrigue that has I have fortunately been unable to satiate for over a quarter of a century. Nelson (1998b, p.2) views this emphasis as technology's mission to explain 'how' whilst science's mission being ostensibly about 'why'.

3.2.5 In acknowledging that, for some technology is an 'object', whilst for others it is 'human intervention', highlights another schism of identification that the word technology seems to be burdened with. I am not sure that the seemingly all pervasive use of the word technology will be viewed to necessarily be a handicap in the longer term. If a common understanding of the word can be arrived at the very fact that it has received such exposure in the latter quarter of the twentieth century may prove to have established it firmly at the core of our 'being' well into the twenty-first century. Such 'advertising' could prove to be invaluable. I make no judgement here as to whether this is a positive or negative observation, merely that it is an observation.

3.2.6 Blake (1977, p.231) draws upon the work of Habermas (1984) in analysing the role and interplay that 'implicit' and 'tacit' knowledge play in creating mutuality of understanding among communicants. My work at doctoral level has required myself as practitioner/researcher to use a variety of language levels to a variety of audiences, and to be able to think and articulate ideas within and across these levels. N.B. I use the word level not in a pejorative sense, merely as a demarcatory noun. Tacit knowledge, as used by Habermas, does not imply achievement and personal attribute of professional, but an inter-subjective precondition intrinsic to acts of communication at an interpersonal level.

3.2.7 In section 3.9 I shall explore the notion of Technology education as possessing volitional characteristics. Custer (Op. Cit., p.240) suggests that although technology can be conceptualised separately as 'impact', 'influence' of 'force' it is not any one of these, but has instead:

> "an effect on entities that are beyond its essential nature."

In Appendix 3.1 I used an example of a BMW executive suggesting that quality was not something that could be described, but one was aware of its presence when attained. Custer's point seems to align itself with this notion of elusive definition. Whilst acknowledging the broad philosophical notion that the very essence, or mercurial qualities, that make some things unique perhaps defy description, I shall continue to explore the epistemology of technology, looking next at the notion of human dimension as facet of technological knowledge.

3.2.8 Technology, as defined by Lind (1998, p.1), is descibed as:

> "Humans utilizing resources to accomplish needs and enhance the human condition."

In the United States of America the 'Technology For All Americans' (TFAA) movement sees technology as:

> "human innovation in action… (the) generation of knowledge and processes used to develop systems that solve problems and extend human capability.
> Radaburgh (Op. Cit., p.1)

An article by Burch (1997, p.3) bears a close resemblance in defining technology as:

> "...the application of knowledge and resources to extend and enhance human capabilities"

Also in the United States of America, Nelson (1998a, p.1) thinks that:

> "Technology is the use of tools and processes to make lives better by extending our capabilities."

In amplifying the above definition, Nelson clarifies that:

> "Technological actions require the use of many resources ~ people, information/knowledge, materials, tools (devices/systems), energy, capital and time.
> (Ibid., p.1)

I have a reservation in such a definition, in that from a personal perspective, as indicated in section 2.2.19 , I rest uneasily in the notion of humans being resources.

3.2.9 Emphasising it more as a process of problem-solving, leads Custer (Op. Cit., p.239) to view technology as a function of a two dimensional matrix of 'goal clarity' and 'problem complexity'. For Radaburgh (Op. Cit., p.2) technological processes: create, invent, design, transform, produce, control, maintain and use products and systems. Custer (Op. Cit., p.239) sees technology as a clearly definable process, something that provides 'arenas of activity' focused around the performance of technological activities.

3.2.10 In the penultimate part of this section several movements, individuals and organisations have attempted to capture the essence of technology by publishing overarching rationales. As they are conceived of as a whole, I include the following examples in their original entirity:

- TFAA (1998, p.1) ~ "Human innovation in action involving the generation of knowledge and processes to develop systems to solve problems and extend human capabilities... technology has a content base which is universal and definable."

- Kozak (1992, p.2) ~ "Technology may be defined as the systems and objects or artefacts that are created using knowledge from physical and social worlds... key descriptors include: innovation, invention, creativity, the extension of human capability, systems of tools, knowledge, behaviours associated with the exploitation of the environment, a consideration of the social, political and environmental impacts, and a consideration of the latest technological advances."

- Saskatchewan Education Department (1998, p.2) ~ "...the intellectual processes, abilities and dispositions needed for students to understand the link between technology, themselves and society in general... the knowledge and skills include:
    - understanding that technology includes hardware, know-how, cultural needs and desires and economic decision making.
    - understanding how technology shapes, and is shaped by individuals
    - understanding that technological issues involve conflicting assumptions, interpretations and options
    - having the necessary data collection and decision making skills to make intelligent choices
    - having the ability and desire to take responsible action on social issues."

- Bouquet (1998) ~ "The key aim of design and technology is to enable pupils to learn how to intervene creatively to improve the made world. It should enable pupils to become discerning citizens and consumers, and contribute to their home, community and industry, by developing and making products that enhance the quality of life.

3.2.11 For myself I have difficulty with the length of such statements, as well as disagreeing with the parts of the content. For instance, 'behaviours associated with the exploitation of the environment', for myself, do not clearly define as to whether this is a positive or negative perspective. My work done with Dr Kidner during the taught doctoral module on 'Ways of Seeing' looking at how cultural relationships with planet Earth differ ~ see 2.2.91 and 2.3.35. lead me to perceive this as an important aspect any consideration of technological capability. When pressed into providing a succinct working definition of technology to satisfy lay-curiosity I resort to the definition I quoted in section 2.1.4, given by Jim Flood:

> "Technology : means making things *work* better".
> (Op. Cit.)

3.2.12 The next section of this chapter looks at International views on technology and 'technological capability'.

3.3 International Perspectives on 'Capability' (or 'Literacy' in the USA)

3.3.1 Wright (Op. Cit., p.6) suggests that as the global economy grows technological ability expands accordingly, therefore making it a social responsibility to prepare technologically literate citizens for the twenty-first century. If economic developments continue in the same vein Fanning (Op. Cit., p.1) suggests that society should be educating independent learners for a post-industrial society.

3.3.2 Stephenson (1993c, p.10) notes the need to develop a coherent attitude toward a capability approach for the 'new Europe'. Assuming primacy of importance is the need for opportunities to be created that get students to plan, negotiate, operate demonstrate and reflect. Cunningham (1993, pp. 212-215) observes that the European Union has created opportunities for students across the EU to live and train or work in different countries, with greater ease than has previously existed. Such prospects raise different issues of capability, such as use of language, the standardisation of qualifications, cultural tolerance, student mobility programmes and career pathway issues. See also sections 2.2.5 and Appendix 3.1 for a discussion of the EU dimension.

3.3.3 In the United States of America, where social mobility has, by necessity, been well established the Academy for the Advancement of Science and Technology (AAS&T) encourages the use of an 'Individual Growth Plan' for each student. The main features of the plan place an emphasis on a strong work ethic, team responsibilities, individual accountabilities, initiative, creative expression and diversity. Such plans seem highly relevant if a recent survey on 'US Competetiveness' by NIST (1996, p.8) is reliable, showing that in ten years the greatest challenge will be provided by needing to keep worker skills up to date. Over 48% of respondents deemed this to be the big issue of the next decade. The importance of training citizens to manage change becomes all the more relevant if such a climate ensues.

3.3.4 Although rocked in recent times by economic turmoil, the 'Pacific rim' continues to be a focus of the attention of economists, in terms of relating technological and manufacturing growth with economics. In Singapore the government have acknowledged this important link by initiating 'NSTP 2000' ~ a government initiative with the avowed intent to create strong indigenous technological capability.

3.3.5 My work on the sensitivities of cultural imperialism and the role that technology transfer has played to the detriment of the developing world in the past, such as the behaviour of the Union Carbide Company in (Bhopal) India during the 1980s, leads me to reflect on what definitions of capability might mean in the majority world. Central to my philosophy is the work of Papanek (1971) whom I first read in 1980 as an undergraduate. When attempting to strengthen technological capability in 'developing countries' Messner (Op. Cit., pp.1-3) suggests that there should be an attempt made to understand what technologies are available, including an in depth understanding of how to utilise, adapt and improve such technologies. Such schemes would only prove a success, according to Messner if they observed 'four pillars of capability':

- make sure producers possess the capacity to innovate and imitate
- help create a framework that create conditions conducive to innovation
- encourage organisations to be oriented positively towards technology
- create an effective system for the provision of quality education and training

3.3.6 In an article addressing the notion of 'Capability for World Citizenship', Cunningham, (Op. Cit., p.222) suggests that it should be the aim to foster individuals who are:

- questioning and critically constructive,
- rational and creative,
- reflective and practical,
- independent and collaborative,
- self aware and outward looking

and

- confident and sensitive.

3.3.7 Blake (Op. Cit., p.225) takes a long term view regarding the development of 'tacit capability' as 'technological accumulation'. Investment in research and development (R&D) does not pay instant dividends but Blake is convinced of the latent public good, however expensive to generate. To this end it is suggested that in education the resultant 'generalisable product' would equate to widespread public understanding of a technological body of knowledge, as opposed to an individual's grasp of highly specific knowledge.

3.3.8 For a final thought on defining capability as it applies generally, rather than in terms of education, or more specifically technology education, I draw on the work of John Stephenson, a prime mover in The Higher Education For Capability (HEFC) movement:

> "Capability is an all round human quality that integrates knowledge, skills and personal qualities, to be used both effectively and appropriately in response to working in both familiar and unfamiliar circumstances. It has a lot to do with values and emotions."
> (1993a & 1993c, p.10)

3.3.9 Having considered 'capability' in broad terms, from various perspectives, I now focus down specifically on *'technological capability'*, but maintain the International perspective by first turning to work from the United States of America, which though assuming the title ot 'technological literacy' has large areas of overlap with 'technological capability', as defined in England and Wales.

3.4 Technological Literacy in the USA

3.4.1 Although I refer in 3.1.1 to the fact that there is a broad understanding of what 'technological literacy' refers to in the USA, thanks significantly to the recent efforts of the TFAA movement ~ see the discussion in section 2.2.50, Barnett (1995, p.120) still notes that one of the perplexities of technology is the fact that interpretations, despite the efforts highlighted above, of technological literacy remain disconcertingly diverse. Lewis (1996, p.222) suggests that technological literacy focuses on disposition to give it a valid claim as a subject. Barnett (1995, p.135) goes on to warn that such phraseology might be interpreted to be more about slogan making than curriculum building, but does at least gesture towards important objectives within the curriculum. The challenge of technological literacy should be to 'expand the tunnel vision' of 'end users' and 'technical experts'. Such an aim requires the examination of the interplay between context and content. For the World Council of Associations for Technology Education (WOCATE), cited in another article by Barnett (1994, p.52), Technological Literacy should amplify the vision of :

> "people adequately prepared to understand and control technology rather than be controlled by it."

3.4.2 The American inclination toward content perhaps makes it easier to view as a discipline, rather than the English and Welsh view of a process driven subject. Lewis (1996, p.233) thinks it imperative that a cogent conceptual framework needs to be made explicit. For the TFAA project, TFAA (1998, p.1), technological literacy involves knowledge about the nature, behaviour, power and consequences of technology from a 'broad perspective'. In such a model the ability to use, manage and understand technology are regarded as axiomatic.

3.4.3 In unpicking technological literacy, Luke (Op. Cit., p.4) describes a three aspect model that he defines as '*critical literacy*'. The argument being that to be technologically literate, one's critical reasoning skills must be developed and articulated. Firstly meta-knowledge rationalises diverse meaning and socio-cultural context. Secondly, a mastery of technological and analytical skills to negotiate is evident. Finally a capacity to understand how systems and skills operate vis-a-vis power is developed.

3.4.4 Although evidencing citizenship as a primary outcome of technological literacy, Newfoundland and Labrador Department of Education (1998a, p.5) postulate that:

> "Technological Literacy is concerned in large part with language, reading, and communications with and about technological concepts, products and issues. Students develop abilities with:
>
> - technical vocabulary and concepts
> - knowledge and understanding of technological, scientific and mathematical principles
> - reading and writing technical material
> - using communications networks effectively and efficiency

- logic and programming

and

- making informed decisions about technology"

3.4.5 Considering the notion of volition Custer (Op. Cit., p.240), suggests that technology is not volition, but has volitional qualities, such qualities helping to mediate the deterministic view of technology. For a detailed discussion of 'Technology Education as Volition' ~ see section 3.9. Wright makes a similar point by identifying technological literacy as the 'power of knowing' about: tools, materials, processes, advances in humankind and the finite infrastructure of the earth.

3.4.6 In the penultimate part of the section several individuals and organisations have attempted to capture the essence of technological literacy by publishing definitions. Due to being conceived of as a whole, I include the following examples, in entirity, from North America:

- <u>Saskatchewan Education Department</u> (Op. Cit., p.1):

  "Technological Literacy can be described as the intellectual processes, abilities and dispositions needed for students to understand the link between technology, themselves and society in general. Technological Literacy is concerned with developing students' awareness of how technology is related to the broader social system, and how technology systems cannot be fully separated from the political, cultural and economic frameworks which shape them"

- <u>Science For All Americans (SFAA) Project 2061</u> (Op. Cit., p.1) defines Technological Literacy as being related to such topics as:

  "...the nature of systems, the importance of feedback and control, the cost-benefit-risk relationship, and the inevitability of side effects give people a sound basis for assessing the use of new technologies and their implication of the environment and culture; without an understanding of those principles, people are unlikely to move beyond consideration of their own immediate self-interest."

- Technology For All Americans (TFAA) (Op. Cit., p.1) ~

"Technology is human innovation in action. This involves the generation of knowledge and processes to develop systems that solve problems and extend human capabilities."

Given my preference for succinct definitions that can be comprehended by the widest audience of both specialist and non-specialist, the TFAA definition has an immediate appeal. However the Saskatchewan statement making explicit the centrality of importance societal considerations have in any intended development or use of technology is, from a personal 'values-led' perspective, crucial. The same is true of the environmental and cultural features of the SFAA Project 2061 definition. My own succinct definition of 'technological capability' (the English and Welsh equivalent of 'technological literacy' in the USA) is located in Chapter 6 ~ see 6.4.3.

3.4.7 Having considered overarching definitions, some writers on this subject have suggested the types of skills it may be desirable to draw out of children and students that may facilitate the realisation of such laudable aims. Lind (Op. Cit., p.1) offers up a list of fifteen skills: honesty, creativity, acceptance, interpersonal skills, common sense, integrity, generalization, group analysis, brainstorming, predicting, mathematical skills, communication skills, plan/organise, objectives being met and evaluating/concluding. Lind goes on to explain that some, not necessarily most, and certainly not all, may be used at any one time in a define, identify, list, make, describe and then display cycle. In this sense display is taken to mean make explicit one's technological literacy.

3.4.8 Madison County Public Schools (1999, p.1) define a similar list of nine 'abilities', to:

- define technology
- explore technological systems
- utilise problem-solving strategies
- develop positive self-images (hands on)
- develop safe skills ~ tools, machines, materials, processes
- identify talents, abilities, interests in technological fields
- develop cognitive (mental), psychomotor (physical) and affective (ethical) problem solving skills
- identify technology related careers
- appreciate technology and the impact on individuals, society and environment.

3.4.9 At the time of writing up this Investigation in the Spring and Summer of 1999, the Government have just given an airing to their proposed 'new' course on citizenship, as a separate 'bolt on' course that can be 'taught' to all pupils. Two elements from the above quotes by Lind and MCPS raised the thought in me again that such issues of citizenship already exist within subject areas. Personal experience leads me to believe that the best place to address issues of citizenship with pupils and students is within subject areas, where it can be contextualised and becomes perceived as an intrinsic part of each subject by learners. An illustration of such a philosophy can be given by looking at the quotes in 3.4.7 and 3.4.8 of Lind and MCPS. Lind highlights the need for honesty, integrity and interpersonal skills to be developed. MCPS see it as important when problem-solving to link together the cognitive, psychomotor and affective so that mental, physical and ethical dimensions function in unison for the benefit of society. I posit that this approach, for me personally as practitioner, will have a greater impact on children, albeit implicitly or in the long-term, as opposed to a discrete, 'grand narrative' type, centrally imposed initiative.

3.4.10 A technologically literate individual, according to Wright (Op. Cit., p.2), is able to learn independently and has well developed interpersonal and teamwork skills. TFAA (1998, p.2) also promote the idea of 'synergism' ~ working as part of a team to eventually develop a series of professional characteristics, as being central to the development of technologically literate individuals. This is one of thirteen characteristics that TFAA have arrived at to capture the essence of what it means to be a technologically literate person:

- capable problem-solvers in a variety of contexts
- recognise solutions to one problem creates others
- understand solutions involve 'trade-offs'
- acknowledge the inter-relationship between technology, individuals, society and the environment
- understand that technology involves systems
- develop the ability to use science, maths, humanities and social studies as tools for managing
- possess a strong orientation to systems approaches for thinking and problem-solving
- identify appropriate solutions and assess/forecast results
- understand the major technological concepts behind current issues
- be skilled in the safe use of technological processes (life-long pre-requisites)
- incorporate characteristics from professionals ~ act synergistically
- understand and appreciate the importance of fundamental technological developments
- develop the ability to use decision making tools in life and at work
- understand that technology is a result of human activity

3.4.11 In 3.4.7 and 3.4.9 the work of Lind emphasises 'personal attributes' and 'interpersonal skills'. In looking at the work of technological literacy I wish to foreclose this section by reflecting upon the notion of technological literacy being especially about people. Radaburgh (Op. Cit., p.1) highlights the fact that it is about people who use, manage and understand technology, perhaps fusing the notions of 'Homo Sapien' and 'Homo Faber'. Barnett (1995, pp.123-124) suggests that technologically literate people know that technology is not magic, but that technological expertise is the only one ingredient in informed technological decision making. For Nelson (1998a, p.1) such technologically literate people are able to value the risks and benefits associated with technology and also to respond rationally to ethical dilemmas caused by technology. For the Saskatchewan Education Department (Op. Cit., p.1) a technologically literate person is:

> "...**someone who critically examines and questions technological progress and innovation**. Decisions of the use of new technologies involve human, social and environmental issues which constrain and limit solutions. Values also influence intellectual processes, since anything that involves choice also involves consideration of whose values are shaping a particular technological development. The capacity to make **critical judgements** involving technology increases the ability of students (as citizens) to use such knowledge to shape and influence their environment."

3.4.12 From an initially wide focus on International perspectives of 'capability' in general, down to 'literacy' as it relates only to technology education but still from an Internationalist perspective, this chapter narrows its focus even further, to consider 'technological capability' only from a (possibly unique) 'British' perspective.

3.5 Technological Capability in England and Wales

3.5.1 The British view of technology education, and in particular the English and Welsh view, has been of a process driven subject concerned with 'doing'. It is against this background that the notion of capability has evolved. This section is concerned with defining technological capability, looking in detail at this 'British' idea, analysing praxis, engaging with the concept of volition and looking at the relevance and application of technological capability to life and the environment.

3.5.2 MacGowan (1998a, pp.1-2) cites the Oxford English Dictionary as defining 'Capable' as 'having the power of fitness'. Nelson (1998a, p.2) is equally clear that technological capability does not simply equate to job specific skilling. In the same article it is posited that technological capability is impacted upon by the extraneous factors of gender, general ability and curriculum experience, and must be considered in any discussion of capability within an educational context. Lewis (1996, p.222) suggests that technological capability focuses on competence and performance. According to Lepki (1996, p.2), competence is concerned with outcomes and performance indicators, whereas capability is negotiable, involving the exploration of relevance and notions of quality, thereby promoting deeper levels of learning.

3.5.3 Acknowledging the difficulty of assessment, Kimbell (1994a, p.80) suggests that the notion of capability often appears to lie in 'psychological' roots, being concerned with 'behaviourism' and 'positivism', as these are more easily observable and assessable than a holistic dynamic process. Kimbell contends that:

> "...a behaviourist model of learning does not fit well to a definition of technology that talks in terms of understandings and attitudes and values and procedural capability. It is just not possible to render down this model of technology to a series of free-standing, compulsory, observable behaviours."
> (Ibid., pp.80-81)

3.5.4 Key 'core capabilities' as defined by Horton (Op. Cit., p.21) include: learning, managing, responding to challenge, being innovative, building relationships and above all making learning count. In a thought provoking article Weaver (1986, pp. 52-59), defines the '6 C's of Capability as: Culture, Comprehension, Competence, Communion, Creativity and Coping. Messner (Op. Cit., p.7) suggests that the development of technological capability is a continuous process. Looking to other associated subjects, Bryce (1996, p.90) defines scientific capability as: curiosity, competence, understanding, creativity and sensitivity.

3.5.5 The particularly British view of technological capability constituting a process of designing and making from which supporting knowledge springs is seen by Lewis (1996, p.233) to imply that capability speaks of performance, of demonstrable competence. In the same article this process driven notion is contrasted with the North American quest to find content that is 'peculiarly technological' ~ as discussed in section 3.4. For Hendley and Lyle (Op. Cit., p.4) the observation by George Hicks, one of Her Majesty's Inspectors (HMI), that designing and making depend on a consideration of values, attitudes and beliefs, is of central importance to the whole ethos of capability within technology education.

3.5.6 Knowing how something works, according to Shield (Op. Cit., p.3), equates to comprehension, whereas comprehension coupled with making solutions equates to capability. MacGowan (1998a), citing the Kimbell (1991) notion of capability being the interplay between three definable qualities, is sure that the essence of technological capability can at least be expressed on paper:

'Procedural Qualities'	~	understanding and expanding, planning and resourcing, developing products, using and manufacturing, valuing and assessing consequences and observing cumulative growth
'Communication Qualities'	~	skills, complexity, clarity and confidence
'Conceptual Qualities'	~	understand materials, understand aesthetics and understand user awareness and people

3.5.7 In considering the interplay between theory and practice, Lewis (Op. Cit., p.228), suggests that the intention of design and technological capability is for practitioners to acquire knowledge and understanding via the processes of designing and making. A similar point is made by Stephenson (1994a, p.1) in suggesting, generically, that capability combines academic excellence with excellence in creativity. This being accomplished by undertaking and completing tasks, working with others and coping with everyday life. Kimbell (1994a, p.65) views this similarly in suggesting that it concerns the relationship between activity and the resources of knowledge and skills needed to pursue capability effectively. In broadening out the discussion on the interplay between theory and practice Lepki (Op. Cit., p.1) identifies five traits regarding the definition of capability:

- the integration of knowledge, skills and behaviour (understanding and personal qualities used appropriately and effectively)
- being broader and richer than concept or competence (concerned as much with future potential as with immediate needs)
- involves the whole person, including values and emotional development/sophistication
- develops the capacity for autonomous learning and personal, vocational and professional development.
- aims to develop the capacity to manage change

3.5.8 The proactive facets of technological capability, embrace the notions of being active rather than passive, suggesting negotiation rather than imposition, application as contrasted with remoteness and combining individuality and collaboration, according to Lepki (Ibid., p.1). Medway et al (1992, p.87) suggests the defining characteristic of technological capability is acknowledging the fact that algorithm and specific rules are inappropriate and that great importance is placed instead on the crucial importance of judgement. This is echoed by the notion of 'personal power to perform' as propounded by Stephenson (1993c, p.15) who suggests that there are three components of capability which make explicit the notion of praxis:

Knowledge and Skills	~	learnt, self-motivated, negotiated, adapted, extended
Esteem	~	proven self-worth, confidence in own ability, and trust
Values	~	set own priorities, and trust own judgements

3.5.9 The Royal Society for the Encouragement of Arts, Manufactures and Commerce (RSEAMC) (1980, p.1) suggest that there exists:

> "...a culture which is concerned with doing, making and organizing and the creative arts. This culture emphasises the day-to-day management of affairs, the formulation of and solution of problems and the design, manufacture and marketing of goods and services."

For Nelson (1998b, p.1), this praxis is summed up in seven descriptors of what it is to be a technologically capable person:

- recognise problems need practical solutions
- develop/evaluate alternative solutions to problems
- select, optimise, apply knowledge and resources to practical problems
- work within imposed restraints and resources
- assess effectiveness of technological solutions
- make value judgements regarding actions whilst solving problems
- feel comfortable learning skills and knowledge in unfamiliar contexts

3.5.10 In Northern Ireland (TRCINI) (Op. Cit., p.14), technological capability is seen as being concerned with 'getting things done' for the benefit of the wider community, by shifting from teacher direction towards student-centred learning. Similarly, Kimbell (1994a, p.65) argues for a 'doing capability' because pupils do not see a world of fixed realities, more a setting in which human beings struggle endlessly to improve their lot. Such a notion leads on to a final consideration regarding technological capability, how relevant is it to issues connected with the lives of human beings, therefore implicitly to the environment.

3.5.11 Many of the points covered in sections 3.5.8 - 3.5.10 possibly also relate to the wider world outside of education. In drawing together this section on technological capability it felt appropriate to tease out a few issues as I perceive them. Messner (Op. Cit., p.3) highlights the importance of networking and mediation as a key pre-requisite to becoming able to be capable of self-help. Both Kozolanka and Olsen (Op. Cit., p.209) and Gorb (1993, p.111), agree with this broad aim, suggesting that it is important to educated individuals to cope with life after school, in both workplace and society. Whilst in agreement with these aims, Weaver (Op. Cit., p.55) and Cunningham (Op. Cit., p.216) suggest the capacity to manage one's own life must be matched by being able to cope with the environment, by profiting from experience and mastery of the art of living, so that sensible decisions can be arrived at. Much in the way that

Francis Bacon envisaged knowledge and skills being used for the benefit of humanity.

3.5.12 Whilst this section, and the associated reading has shaped my views of technological capability, I remain as convinced as when joined the profession in 1983, that one of my central roles as a 'technology teacher' is to educate students to appreciate wider societal issues and what career opportunities may be available for technologically capable individuals. For my summative thoughts please refer to Chapter 6 ~ section 6.4.3.

3.5.13 I now turn to 'technological capability' as it relates to education and to teaching processes.

3.6 Teaching and Technology Education in the late 1990s

3.6.1 As a technology educator, although unhappy at the initial lack of consultation afforded to professionals working within education, in schools, universities and colleges, children have undoubtedly benefited from the introduction of a national framework for education in England and Wales. The National Curriculum has ensured that the consciousness of design and technology in the minds of parents, pupils and fellow professionals has been raised. Although somewhat different than first envisaged back in 1988 ~ see 2.1, I would suggest that there is greater clarity and uniformity of experience for pupils than was the case prior to 1990. As someone who has actively engaged with the concept of change as a doctoral reader, and also been subjected to change as a practitioner for a period of sixteen years since joining the profession, I feel it important to stress the apparently positive facets of radical change.

3.6.2 In any discussion of education, I have always believed in the active pursuit of knowledge, as opposed to sitting back and letting the experiences osmotically wash over me. I read with interest the work of Splitter (Op. Cit., p.97) who cited Kant as likening concepts without concrete experience to a series of empty pigeon holes. As a teenager I was fascinated by John F. Kennedy, and longed to study history starting in November 1963, working backwards. I always remember the empty feeling I had when ploughing through seemingly endless sketches of fraters and Roman forums, yearning to get home to read exactly what did happen at the Bay of Pigs in Cuba. As a young technologist I seem to recall my interest in modern history was sparked off by nuclear weapons and the 'Cuban missile crisis'.

3.6.3 Inevitably, as a teacher I remain convinced of the benefits I strive to '*educe*' from my practice, but mindful of the fact that I have not always met with universal success as a practitioner. Reading an article by Solomon and Hall (Op. Cit., p.276) in which they suggest that from the writings of Jean-Jacque Rousseau to those of Ivan Illich some see schooling as a hindrance.

3.6.4 Within the field of education Gradwell (Op. Cit., p.259) suggests that we could learn from recent curriculum revolution, by acknowledging that top-down curriculum revision that is imposed has never had an enduring effect without radical change, as witnessed by the 'Dearing' revisions of 1995 ~ see 2.1.10. Such imposition, according to Layton (1995, p.106) allows for sound bites like the Smithers and Robinson Report's (1992) now infamous "Technology in schools is in a mess" (p.1), to radically change Government thinking, despite such reports lacking credibility in terms of sound quantitative analysis ~ see 2.1.10 and Appendix 2.3.

3.6.5 As an undergraduate in the late 1970s I had expected to be given the knowledge required for a career in technology teaching, with a few courses to 'trim' my knowledge. Clearly this has proven not to be the case. As Lewis (1996, p.234), points out, the dynamism generated by elapsing knowledge and emerging knowledge has become an essential feature of the teaching of Design and Technology that all practitioners need to embrace. The development in computing power over the last two decades provides a poignant example; I had never envisaged becoming a network manager of a school computer system with only two days of training. I do not suggest that such situations do not in turn create problems. As Sane (1998, p.1) notes, schools often suffer from problems associated with the high cost of rapidly changing hardware and the absence of suitable Inset. This ability to actively manage elapsing and emerging knowledge is perhaps what Cosgrove and Schaverien (Op. Cit., p.3) refer to as the unique essence of technology education, that in turn can make a unique contribution to the curriculum of a school.

3.6.6 In the discussion of meta-cognition, ~ see 2.3.32, the notion of critical thinking was discussed as being an important facet of capability ~ see also 3.1.6. As Jewell (Op. Cit., p.80) notes there is a paradox in teaching students to use critical reasoning, in that the more efficient they become in its use, the less obvious it becomes as to whether or not it is being done effectively.

3.6.7 A final introductory thought relates to the issue of teacher loading and the management of time. Three initiatives that have had an impact upon teaching in the last decade have been Ofsted, School Development Planning (SDP) and initiatives connected with proactive 'off the peg' management solutions such as Total Quality Management (TQM). I discussed TQM in section 2.2.9, but the two initiatives to have taken up a lot of teacher time in recent years have been Ofsted and 'SDPing'. Regarding the issue of time away from working with pupils and students, Ball (Op. Cit., pp.334-336) cites Lyotard's observation that the more one spends measuring, the less time one spends with the measured. As a middle manager with some whole school responsibilities, on a personal level experience deems this to be the case.

3.6.8 Ball's article suggests that some of the tools of management in education appear to have made use of post-modernism and the disappearance of the grand narrative. Some managers have become 'professional technocrats' who operate in a 'promiscuous, teleological means to an end' paradigm. Others, Ball contends, have become 'simulacrumic', creating organisation for gaze or avoidance. The Foucauldian notion of micro-circulations of power is something that I have become more acutely aware of within committees and meetings as a practitioner, than I had prior to enrolling on the taught doctorate.

3.6.9 A final thought that I found enlightening in the Ball article was the idea that a lot of good quality work is carried out at the 'micro-disciplinary' level, work that feeds into the bigger picture of how a school is perceived by parents and fellow professionals. Thankfully it is not just the 'grand' gestures that are held to be of significance.

3.6.10 To sharpen the focus still further into my main research question, concerning contextual influences on the development of 'technological capability', I now consider 'A' level characteristics, as the post 16 age range was the chosen phase for the Action Research phase of this Investigation.

3.7 Characteristics of National Curriculum and 'A' Level Technology

3.7.1 The work I have highlighted in sections 2.2, 3.4 and 3.5, indicate the disparate views there are regarding technology education. The remaining sections of this chapter are concerned with focusing down upon ideas that have, from my field research and from my literature search, began to crystallise in my own mind regarding the provision of a clear working definition of what technological capability is, within the context of design and technology education. The synthesis of a definition, that can be traced as having evolved over the following sections of this chapter, informed Cycle 2 of my action research, which involved taped interviews.

3.7.2 Greater uniformity of experience has been achieved across Key Stage 3, Key Stage 4 and Post 16 provision in terms of Design and Technology, largely due to the introduction of a National Curriculum for students of compulsory school age (modified by Sir Ron Dearing) and the introduction of a 'Common Core' that is shared by all 'A' level Design and Technology syllabuses. Although Hansen and Froelich (Op. Cit., p.203) mirror reality in suggesting that technology education is 'eclectic', concerned as much with art as science, with divergence and convergence, with induction and deduction, with social, political, and personal fulfilment, there has been a good deal more clarity achieved over the last decade than was previously the case ~ see 2.1.

3.7.3 The review of the National Curriculum, for Key Stages 1, 2, 3 and 4, due to be implemented in September 2000, is currently in the consultation period. The draft aims of the new syllabus for Design and Technology has been sent to the Secretary of State for Education for consideration over Easter 1999. The following is an extract from a working draft produced on 22nd January 1999. It suggests that the distinctive contribution that design and technology makes to the school curriculum is:

> "...by preparing young people to cope in a rapidly changing technological world. The subject enables them to understand how to think and intervene creatively to improve that world. It helps pupils to become discriminating users of products, to contribute to their home life, the community and, in due course, it broadens their understanding of industrial production, as they develop systems and make products which enhance the quality of life. Through design and technology pupils learn to become autonomous,

> creative, problem-solvers both as individuals and in working with others. They achieve this in two ways, firstly through developing their personal capacity in combining knowledge and understanding with designing and making. Here they learn to recognise needs, wants and opportunities and respond to these by producing a range of ideas which they critically reflect on and evaluate from a variety of perspectives- use, production, marketing and environmental. Secondly, through considering the design and technology that exists in the world outside school both now and in the past. Here they develop the ability to consider critically the uses and effects of design and technology."
> QCA (1999, p.1)

Whilst fulsome and informative, personally it appears verbose and fails to capture the essence of uniqueness, in the same way that the TFAA (1998, pp.2-3) definition of the universals of technology as "knowledge, processes and contexts" also fails. The 1993 'Dearing' definition of design and technology capability, as described by Layton (1995, p.109) was more useful to myself as practitioner:

> "...pupils combine designing and making skills with knowledge and understanding to design and make products."

A personal feeling leads me to believe that a working definition must be able to be largely recalled, but must not be so vague as to be applicable to many subjects.

3.7.4 As my research question is concerned with technological capability at 'A' level, I now focus down specifically upon the post 16 phase of schooling. Threlfall (1988, p.8) suggests that distinguishing features of 'A' level design and technology centre around the complex process of designing and making which involves appreciation of material behaviour and human behaviour. The broad 'A' level aims for design and technology, according to Jeffrey (1990, p.26) are threefold:

- to participate in designing and meeting needs
- encourage students to exercise initiative, imagination and resourcefulness
- help students to develop critical awareness of the made world

3.7.5 I now focus in on the 'A' level syllabuses of the Associate Examining Board (AEB), University of London Examinations and Assessment Council (London), Joint Matriculation Board (JMB) and the University of Oxford (Oxford). Although recent mergers have taken place, these terms still bear significance for practitioners within the field of 'A' level Design and Technology.

3.7.6 In analysing the 'current' syllabuses for stances on capability, prior to the 'new' Year 2000 'Dearing' 'A' level syllabuses, the AEB define the essence of 'A' level design and technology as using technological and other knowledge, and to apply it to the designing of devices, products and systems. London board suggest that:

> "the development of an essential continuum of work of open ended and problem solving nature with an intellectual content reflected by the maturing of experience in design allows candidates to understand the implications of design and technology on society"
> Norman (1993, p.47)

gets to the heart of design and technological capability. For the Oxford board, more heavily emphasising design, they view design as an integrating process satisfying human needs and shaping values whilst at the same time understanding environmental issues and appropriate technologies within production processes.

3.7.7 In contemplating a definition of technological capability, considering the views of the 'A' level examinations boards has proven to be both illuminating and personally beneficial. It is now my intention to look at technology education from historic, volitional, humanist, process, academic discipline, outcome, process and vocational perspectives. It is also my aim to consider the interplay between each to try and arrive at a working definition that I can usefully commit to memory for ease of explanation to colleagues and lay people.

3.8 Technology Education ~ an Historical and Epistemological Analysis

3.8.1 The roots of technological education can, as defined by Gradwell (Op. Cit., p.240) be traced back into ancient history, with many definitive nodal points to chart its progress up to the present decade. Ancient Jewish 'handiwork' and the Greek acknowledgement of the existence of human as maker, or 'Homo Faber' are two of the earliest examples. In the middle-ages the religious orders of Monks living lives that combined growing, writing and making, with Franciscan orders placing religious significance on handiwork as a dignifying medium. Although Thomas Acquinas was said to have reservations about the relevance of brothers undertaking manual work, both Francis Bacon and Jean-Jacques Rousseau were said to acknowledge the importance of making within education as it contributed to all senses being deployed in the learning process.

3.8.2 Appendix 2.1 deals with the key points in the development of design and technology education in England and Wales up to the present decade, from a personal perspective. Instead of rehearsing these points again, as we live in an era of greater European integration I have drawn examples from the French tri-partite system as it evolved in 1635, pre the French Revolution, during the Renaissance. In looking to Europe I am mindful of the work of Nordenbo (1995, pp.37-41) who cautions to be mindful of chauvanism, relativism and alternativism when making comparisons across cultures. Gradwell (1996, pp.243-252) suggests that the strong scientific underpinning of technology education ensured that the tri-partite system of secondary education, that largely failed in England and Wales, produced a number of renowned French engineers whose names are now legend. The graduates of Les Écoles Centraliens (secondary technical schools) with a strong emphasis on mathematics and physics included: Blériot (aviation), Peugeot (automotives), Eiffel (structures and steel) and Michelin (tyres and rubber).

3.8.3 In France, science has always been a strong feature of technology, whereas in England and Wales design was strong, Gradwell (Ibid., p.259) notes that the shortage of labour in the United States, as experienced by early settlers in New England led to a faith in the machine ethic, something that prevails to the present day. With such disparate international approaches to the same curriculum area, Gradwell suggests that there is little wonder that the subject always appears to be in a state of constant flux.

3.8.4 Given this perception of a subject whose foundations appear to be built upon shifting sands, there is a need to look at an epistemology of technological education. Solomon and Hall (1996, p.265) suggest that an epistemology of technology education uniquely offers children both distinctive ways of working and also places special emphasis on its grounds for validity. For example designing <u>and</u> making offers children a distinctive way of working, and evaluating the resulting product places special emphasis on its grounds for validity. In relating this back to my discussion of unique combinations of generic command verbs ~ see 3.1.6, my emergent conclusion of an epistemological and historical analysis of technology education is that it is perhaps neither designing, making nor evaluation that make technological education unique, merely the unique combination and emphases of such activities that gives design and technology education its right to exist as an experience worthy of study by all citizens. Layton (1995, p.113) labels this as technology education's 'epistemological warrant', a unique cognitive code. For Lewis (1996, p.224) as a purveyor of practical, situated knowledge, technology's 'time has come'. My reflective thoughts and own definition is found in section 6.4.5.

3.8.5 Such a notion may be supported by the work of Medway (1992, p.63-88) who suggests that 'epistemological underpinning' occurs not from explicit characterisation but by deduction from an exhaustive set of examples, which often assume the rather nebulous term '*real world practice*'. Although there may occur what Lewis (1996, p.234) defines as an 'epistemological difficulty', as changes in technology cause a 'dwell', it would be seen as unlikely that such changes would affect the whole of the body of technological knowledge, albeit that a significant progression in cutting edge technology may, over time, affect a major change in a particularly large part of the body of knowledge. As the subject continues to assume a more settled framework nationally ~ see 2.1.12, 3.6.1, 3.7.2 and Appendix 2.3, the less danger that the subject will be subjected to such radical changes of identity. From a personal point of view I welcome such developments, but trust that this will not be taken as a 'charter for stagnation' in the future.

3.8.6 I now turn to another facet of technology education, in considering the notion of technology as possibly possessing 'volitional' characteristics.

3.9 Technology Education as Volition

3.9.1 The word volition I am interpreting to mean 'the act or power of using one's will'. Thereby implying that one interpretation, or aim of technological education, may be to possess the will or desire to make things happen or achieve something. As outlined in section 3.6.2. my own approach to education has always aimed to be proactive and participative, I have always felt the urge to do thing to the best of my ability with enthusiasm. I acknowledge readily that I have not always been successful but I assert that, charged with enthusiasm, I have always wanted to do the best I could and enjoy trying new experiences, even when success could not be guaranteed.

3.9.2 In posing the question, Is fluency in design and technology in part due to collaborative working or importance of quality of oral exchanges? Medway (1994, p.86) first drew my attention to the notion of technological education being about interaction with others, uniting in a desire to achieve a particular end. Fanning (Op. Cit., p.2) suggests that technology is not just about tools and materials, but is a medium to mediate experience in many aspects of life. In equating technology education to the world of work by suggesting that it is concerned with the development of habits thought to be transferable, Kozolanka and Olsen (Op. Cit., p.216) stress the importance of such a notion producing quality work, co-operation in team work and being resourceful. Cosgrove and Schaverien (Op. Cit., p.10) acknowledge the importance of fostering in children an awareness of the wise use of technological capabilities and other systems that arise from them.

3.9.3 Using a notion borrowed from the German Enlightenment of the late 1700s, that of 'Bildung' ~ the capability to use reason without external help, Hansen (Op. Cit., p.37) indicates that a holistic approach to technological capability deems its use appropriate. This, it is argued, emphasises the use of critical reflection, and implies that some choice in activities to experience, as well as being able to trace back objects to the values systems they emanated from, are central to 'Bildung' for technologists.

3.9.4 Suggesting that technology is not coterminus with other disciplines, Hansen and Froelich (Op. Cit., p.202) postulate that technology education is less of a discipline, more one's own experiences of education, following an 'experiential pedagogical philosophy'. Such a notion allows technological capability to be defined as education being shaped by one's own personal experiences and actions. Hansen and Froelich (Ibid., p.190) further define volition as being concerned with aims, intentions, desires and choices. My own succinct definition is located in Chapter 6 ~ section 6.4.6.

3.9.5 Turning to a different conceptualisation of technology education, I now consider human dimensions, and possible effects.

3.10 Technology Education as Humanist Discipline

3.10.1 In developing the notion of technological education being about developing a sustainable humanity, I have drawn extensively upon the work of Hansen and Froelich (Ibid.), who suggest that there are four main modes of exploration vis-a-vis the notion of technological education as humanist discipline:

- Historical viewpoint ~ remote past, immediate past, immediate future
- Sociological Investigation ~ the nature and character of technology and society
- Anthropological Investigation ~ the relationship between technology and the evaluation of humankind
- Phenomenological Investigation ~ the study of behaviour of technology, society and ideological systems

3.10.2 A significant part of Chapter 2 of this Investigation, charting the development of technology education ~ see 2.1, the introduction of a national framework ~ see Appendix 2.3, and points of personal significance ~ see section 3.3.5, do constitute such an historical viewpoint, especially when acknowledging that action research is one's prime *modus operandi.*

3.10.3 The anthropological perspective is aimed at giving human meaning to social and technological change. Recognising technology as being undertaken in all cultures (*a universal*), requiring the application of organised knowledge (*synthesis*) and tangibles (*tools and materials*) for the extension of human faculties Hansen and Froelich (Ibid., p.184) cite Pytlik et al (1985, p.7) in giving an anthropological flavour to three facets of technological education. Firstly that technology embraces the means by which humans control the natural environment. Secondly that people use materials, tools and techniques of their environments to satisfy human needs and desires. Finally that technology is a major means by which people adjust to their environment. In acknowledging my commitment to the belief that values, assume central importance in technological education ~ see 2.2.77, 2.1.5, 2.1.11, 3.0.1, 3.1.5 and 3.4.6, I am drawn positively towards this anthropological dimension as being an important factor in defining technological capability in design and technological education.

3.10.4 As an undergraduate I was greatly influenced by my sociology lecturer, Dr. Jack Demaine in looking at issues of equality and social justice. My own political beliefs and personal experiences have shaped my desire to offer children of all abilities and social backgrounds as well as both genders the opportunity to participate fully in society by gaining the best education and extra-curricular experiences I was able to offer. To this end I have over the past seventeen years undertaken many outdoor pursuits trips with children to build teams and the type of social cohesiveness I strive to achieve, coupled with an appreciation of the environment that mountaineering has to offer. Against this backdrop I find the notion of analysing technology in terms of what social factors shape change, perceived to be 'unalloyed blessing' or 'unmitigated curse' ~ Hansen and Froelich (Op. Cit. p.185) to be particularly influential on my own emergent perspective.

3.10.5 From a philosopher's viewpoint, if technology is viewed more as a branch of moral philosophy rather than science, Hansen and Froelich (Op. Cit. p.187) argue that such a perspective allows for the comprehension of the elusive mental dimension of technology, what Aristotle rather grandly referred to as 'Phronesis' ~ practical wisdom as opposed to technique. Whilst I do not see technology as an either/or scenario, I can again perceive a link between my notion of unique combinations of verbs to define subject essence ~ see 3.1.6, and the interplay of the four facets of the humanist perspective as outlined by Hansen and Froelich.

3.10.6 Technology education for Kozolanka and Olsen (Op. Cit., p.215) is not just a subject, but a means to find out about people. In developing 'practical capability', Kozolanka and Olsen (Ibid., p.224) suggest teachers want children to transcends the *instrumental* to become *moral*; technology is concerned with *virtue* and *vocation.* According to Layton, the nature of design is human activity as relating to the configuration, composition, meaning, value and purpose lying behind made phenomena. Barnett (1995, p.129) agrees that the interplay of technology and humanity is concerned with both the sociology of made things and an analysis of landscape as artefact. Kimbell (1994b, pp.242-244) draws on the work of Bronowski (1973) in acknowledging that driven by human desire, technology is a most human feature, one of the hallmarks of humankind. In developing this point Kimbell suggests that boundaries in technology are not set by current practice and understanding, more defined by human desires. This point relates to the notion that cutting edge technology, whilst altering significant portions of technological knowledge should not actually cause radical crises of identity in the future ~ see 3.8.5.

3.10.7 The development of a 'Neo-Humanistic Scholarship', as defined by Barnett (1995, p.129) is characterised by three divisions of the material world: human beings, made things and the natural world. With due deference to my supervisor, this appears to express the most complex idea in very simple terms, as well as managing to capture for me the essence of the humanist dimension of capability in technological education. In 6.4.7 my own focussed definition of technology education as a human discipline can be found.

3.10.8 The next section reflects upon a more widely understood perspective on technology education.

3.11 Technology Education as Process

3.11.1 Although Layton (1995, p.97) suggests that the Keith Lucas Report ~ see Appendix 2.3, tried to identify the essential components of good design, Schön (1996, p.1) suggests that there has yet to be produced a good theory of designing, that captures its essence of complexity and uncertainty. For Murphy (1992) the design process is endless and inexhaustible, with no infallably correct process (or optimal solution) for finding as well as solving problems. Designing, it is posited, is largely about subjective value judgements (unable to be comprehensively stated) and prescriptive activities; designers work within the context of a need for action.

3.11.2 Technological problem-solving as a process, according to Custer (Op. Cit., p.233) has three primary facets:

- Resources ~ totality of physical, material, psychological and knowledge
- Primary Processes ~ designing, repairing, negotiating, counselling and hypothesis testing
- Goal Thrust ~ i) creation of physical artefacts
  ii) the development and maintenance of healthy, efficient and meaningful relationships
  iii) a need to understand the physical world

These three facets are then developed into a model that compares goal clarity to problem complexity.

Custer's Problem-Solving Model

(Intrinsic frame of reference for problem-solving)

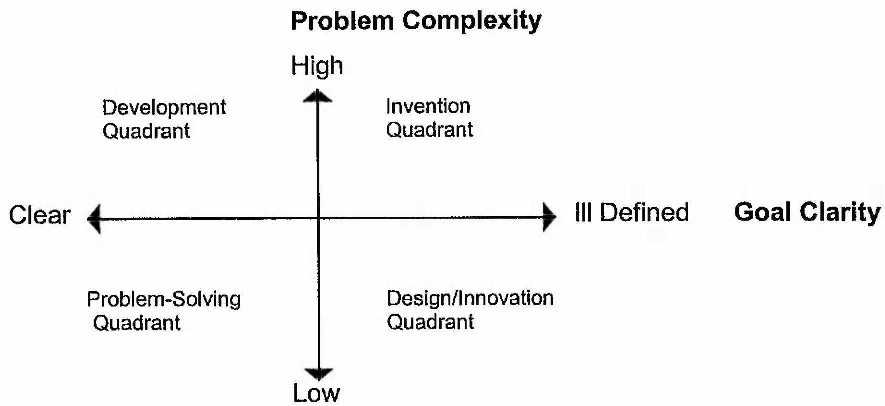


Figure 3.1

The model in Figure 3.1 suggests that, for instance, if a problem is complex, yet ill defined it constitutes an invention, whereas if a problem is simple and clearly defined then it becomes more a matter for problem-solving.

3.11.3 Cowan (Op. Cit., pp.2-5) suggests a more 'traditional' cyclical model of the design process, concerned with the modelling of ideas in the hand and mind. The 'elements' of such a process being to design, make and evaluate geared towards making a perceptible change. Co-operation, brainstorming, researching and serendipity, with teacher as facilitator, are implicit in such a process. For Cowan modelling is the cornerstone of capability in technology.

3.11.4 In pointing up the differences between engineers and technologists, for Burgess (Ed.) (Op. Cit., p.68), one crucial difference is seen to be the emphasis placed on method as the most important thing in technology, as opposed to knowledge, *'efficacy testing'* of what students can '*do*' as opposed to what they '*know*'. Radaburgh (Op. Cit., p.1) also refers to the dynamics of problem-solving, enabling students to gain experience working with a wide variety of technological devices and processes. Solomon and Hall (Op. Cit., p.279) describe the process of comparing outcome with drawing as 'meta-learning'. This has been a guiding principle of how and why I teach technology and is reflected in my own definition technology as a process in Chapter 6 ~ see 6.4.8.

3.11.5 The next two sections examine perhaps the two most commonly understood interpretations of technology education, technology as body of knowledge and technology as an outcome (product).

3.12 Technology Education as Body of Knowledge (Academic Discipline)

3.12.1 Weaver (Op. Cit., p.53) suggests that comprehension is concerned with knowledge in both breadth and depth:

> "...knowledge being the amplifier by which mankind has obtained an intellectual grasp of the environment."

Foster and Wright (1996, p.6) suggest there are two clear approaches to deliver technology education, one being based on the integration of mathematical, scientific and technological knowledge, the other being through teaching the design/problem-solving process ~ see section 3.11. TFAA (1998, p.1) see no such schism, suggesting that technology education is problem based learning utilising mathematics, scientific and technological principles. For McDowell (1998, p.1) the *raison d'etre* of technology education hinges on the emphasis placed on its conceptual basis, as opposed to concentrating on skills, materials and modelling. McDowell goes on to clarify that:

> "Technology education is an academic discipline with a body of knowledge based upon a valid research process."

3.12.2 Four things exemplify technological education, according to Daugherty and Wicklein (Op. Cit., p.5): *methodological characteristics*, *curriculum content*, the *integration of perceptions* and *action plans*. There are many different models of curriculum content to draw upon, I illustrate an eight strand example from TFAA (1998, p.1):

- Application of technological systems
- Impacts of technological achievements
- Problem-solving using technology
- Informed decisions about technological resources
- Use of tools, machines and materials as technological resources
- Application of scientific, mathematical and other knowledge
- Exploration of technology based careers
- Multicultural and gender diversity

3.12.3 Cosgrove and Schaverien (Op. Cit., p.13) suggest that there are three interwoven strands of relevance to technology education:

i) *A 'traditional' base of academic rationalism* (language education and scientific literacy) uncovering the great ideas of one's own culture

ii) *An intellectual process curriculum*, encouraging children to interpret their own thoughts (Meta-cognition)

iii) *Considerations of social expression*, being sensitive to the wise use of technologies

3.12.4 For Wallett and Duckett (1993, p.2) there are four areas of competence that pertain to technology education: *technical, educational, ethical/social*, and the *specialised development of resources*. It is suggested that although a body of knowledge exists, it is how the body of knowledge is used in conjunction with the other competencies that governs its worth in terms of capability.

3.12.5 Gorb (Op. Cit., p.111) notes that it is:

> "...sad to observe the extent to which technological subjects have all too often become fixed in an academic mould which, for example, treats engineering as applied science... understanding on its own is not enough, even if it succeeds in creating among the young an admiration for the world of industry and commerce, and a desire to work within it. Effective performance in industry requires action as well as appreciation, and 'know-how' even more than knowledge."

3.12.6 As my research question concerns the teaching of 'A' level Design and Technology, my final thoughts on technology education as body of knowledge rest with Professor Smithers (1994, p.362). In discussing the long awaited review of 'A' levels, Professor Smithers suggests that a 'Baccalaureate' of mixed 'A' levels allowing engineering departments to acknowledge fully the capability thrust of 'A' level design and technology as having parity of esteem alongside the 'tradition giants' of mathematics and physics, might be seen to serve the country well in the future. My own definition of technological education as academic discipline is shown in Chapter 6 ~ section 6.4.9.

3.13 Technology Education as Outcome

3.13.1 When considering artefacts, its not the form that is the distinguishing criterion, according to Custer (Op. Cit., p.224), but the values, priorities and needs of the culture that are expressed through the creative energies of people. Such infinite forms and diverse cultural expressions demonstrate great ingenuity and creativity of human spirit. Custer goes on to cite Bensen (1992) in observing that what we can observe all around us in the made world happened first in the minds of people. This interplay between the tangible, esoteric, physical and non-physical is the theme of a thought provoking article by Langdon Winner entitled 'Do artifacts have politics?' in MacKenzie and Wajcman (Op. Cit.).

3.13.2 Medway (1994, pp.89-90) suggests that the products of design and technological activity are symbolic, and bound up in semiotics. Before being constructed they are envisioned by the maker, as such they reflect the personal perspectives of individuals. In considering the outcomes of design and technological activity Kay (1994, p.40) cautions that assessment of any form uses words and phrases rooted in a symbolic hinterland. The deployment of assessment language should not restrict or confine the imagination, the very thing that is being assessed. To avoid this Kay suggests that a 'crisp new collaborative dialogue' is needed to reflect innovative thinking. In Appendix 3.1, I highlighted the need to measure what we value, not value what we can measure, the danger of failing to get behind the physical presence of an object to assess the thought processes must be recognised. If only the object is assessed then the communication might be lost. Communication that is multi-dimensional: extended technical vocabulary, spoken and written narrative, presentation, personal explanation, instruction, report, description, persuasion, expression of opinion and feelings.

3.13.3 Building upon an earlier notion of 'text as things' ~ see 3.1.4, the corollary of such an approach is to treat the written word as object or artefact. Barnett (1995, p.130) suggests that technological change requires an analysis to find out exactly what is new about new technologies. To do this one must clearly analyse existing technologies for a measurement datum. Such historic referencing does help to contextualise technological developments. Establishing how different technologies inter-relate, according to Barnett, will be an important skill to possess.

3.13.4 In this section I have deliberately moved the argument above the level of product as technology. Referring to an overhead projector (OHT), radio, car, washing machine or play station as technology is well established and understood widely. What is often overlooked is the need to associate objects with the culture and attitudes of their creators. This is reflected in my own definition located in the conclusion, see Chapter 6 ~ 6.4.10.

3.13.5 The final paradigm I consider vis-à-vis technological capability, is the one that Industrialists and Politicians alike are often characterised as being most preoccupied with.

3.14 Technology Education as Economic Vocation

3.14.1 Having left school in June 1979, one month after Margaret Thatcher became Prime Minister it was some sixteen years later before the Conservative party relinquished power, myself now being in my mid-thirties. To observe that 'Thatcherism' has had an influence upon my practice is obvious ~ see 2.2.12, education changed radically from the time I trained as a teacher to the mid 1990s. The teaching of design and technology was highlighted by Prime Minister Thatcher as being problem-solving to satisfy market needs, according to Layton (1995, p.97)

3.14.2 During the same period, although benefiting from a coherent framework of NVQs and GNVQs, there still appears to exist a pernicious schism between academic and vocational education. Although many university undergraduates now enter via the vocational pathway there is yet to be a tangible acceptance of vocational pathway as equal partner in post 16 education. Pring (1992, pp.131-135) observes that the challenge of having too narrow an academic curriculum will eventually prove to be an overburdening shortcoming. For Pring it is important that Further and Higher Education should assess aims, values and standards when preparing students for life outside of education.

3.14.3 For Tight (1995, pp.383-384) education plays a vital, if indirect role in the economic life of nations. This contribution is discernible at three levels:

- **Individual** ~ investment in one's own future
- **Organisational** ~ expenditure on training for survival and development
- **Societal** ~ increase participation in F.E. and H.E. and continuing education

3.14.4 Lewis (1996) cites Hannah (1987) in suggesting that technological education submits to a duality of purpose, being concerned with economic well-being and servicing general education. On a personal level I have always objected to the notion that the only valid claims for technological education were in terms of a 'craft for the daft' approach that saw the subject lacking esteem, indeed helped to brand lower ability children as being fit only to 'do' instead of being able to 'think', and also identifying the subject solely in terms of making ~ making things and making money. I do, however, place emphasis on being able to generate wealth to sustain the many programmes of social justice that I am committed to. I am proud of the fact that over the past decade I have helped more than twenty students gain university places to read Engineering, confident and proud of the fact that they will make a positive contribution to the British Economy. What I do feel charged to do is to help broaden the understanding of technology, and in turn raise the debate beyond the notion of technology as 'things' and 'useful jobs'. This duality of purpose, developing the individual but at the same time considering the well being, economically and socially, of wider society is reflected in my succinct definition of technological as economic/vocation is located in Chapter 6 ~ section 6.4.11.

3.14.5 From a personal perspective I think that , taken all together, the notion of seven facets of technology education, as discussed above, that may interact to help develop 'technological capability' in individuals has implications for management within education, and also for the management of change. For my overall definition please refer to section 6.4.3 in Chapter 6.

3.15 Issues of Leadership in Education

3.15.1 In looking to move into a role in senior management within a school, I have become aware of how issues surrounding this Research Investigation, my emerging understanding of 'technological capability' and the taught doctoral modules on 'Ways of Seeing' and 'Management of Change' appear to impact upon my preparations. I have also been drawn to the issue of managing change, drawing a direct parallel with the evolution of the subject that I have taught for the past sixteen years. I can see how many facets of my subject, as discussed in this chapter, would possibly provide desirable attributes for a senior manager to possess. Notions of volition, humanism, process, academic discipline, and vocation seem to be facets of the successful management of schools at the turn of the century.

3.15.2 Leadership and management, according to Fidler (1997, p.25) are very much about concern for people and concern for results. In developing this perspective, Burgraaf (1997, p.67) suggests there are five 'functional areas' that a manager operates within: *planning*, *organizing*, *controlling*, *motivating* and *co-ordinating*. West Burnham (1997, p.235) identifies six concepts for leadership: *intellectuality*, *artistry*, *spirituality*, *moral confidence*, *subsidiarity* and *emotional intelligence*.

3.15.3 Fidler (Op. Cit., pp.27-32) proposes five perspectives on leadership:

- **Situational** ~ context specific and dependant upon 'key variables' such as preferred leadership style, maturity and expectations of followers and the nature of the task to be tackled.

- **Bolman and Deals 'Four Frames'**
  - Structural ~ goals and rational analysis, hierarchy of control
  - Human relations ~ harness the motivation and commitment of employees

- Political ~ recognition the individuals within and outside have their own agendas
- Symbolic ~ visionary, creator of possibilities, provides followers with a rationale.

- **Leading Professional and Chief Executive** ~ symbolic, political and managerial, delegates well.
- **Moral Leadership** ~ values-led.
- **Curricular Leadership** ~ takes a major pro-active role in the teaching and learning of a school.

3.15.4 A final thought on leadership is provided by Fidler (Ibid., p.24) who suggests that whichever leadership model or style one adopts, there are three possible outcomes: *approbation*, *neutrality* or *dislike*. A sobering but, from personal experience, pragmatic thought. I now look at the challenge which change potentially creates, from an optimistic viewpoint.

3.15.5 My own management style continues to evolve and, in a similar way to my research methodology ~ see section 4.0.1, it is somewhat eclectic, drawing on each of the models highlighted in this section, plus knowledge of how to motivate and team build, emanating from my experiences as a middle-manager in schools, being a committed mountaineer/rock climber, and a long-standing co-ordinator of the Duke of Edinburgh's Award Scheme. Section 6.6 alludes to my emergent philosophy as it stands at the end of the Investigation. It continues to develop and to (hopefully) be refined. A central plank of my leadership philosophy is to place human beings and 'values' at the centre of developments and changes. In Chapter 6 ~ section 6.6.4, some examples illustrate how I have begun to implement my philosophy.

3.16 The Challenge of Change

3.16.1 As the notion of change and managing change has been a central feature of both my professional practice and the taught doctoral journey, I felt it appropriate to reflect upon the impact that change might bring to bear on the notion of capability. I intend to look at change from a whole school perspective, followed by a look specifically at change from a design and technological perspective. Nuttgens (1983, p.31) suggests that change and freedom are not matters for thought and analysis alone, they are also matters for making and doing.

3.16.2 A technological society, according to Hansen (Op. Cit., p.36) is challenged by the dynamics of change and by the static character of its products. O'Duill (Op. Cit., p.33) notes that changing to a relevant curriculum is difficult, but inescapable eventually. Chiswell (Op. Cit., p.417) cites Schön (1983) in observing that:

> "schools are dynamically conservative, they fight to stay the same."

Holcomb (Op. Cit., p.1) makes a similar observation by noting a paradox in the fact that whilst society experiences large changes in values, systems and new technologies schools seem largely immune, with the existence of selective grammar schools still a feature in many towns across the country. Locke (1997, pp.285-287) notes that changes in institutions are instigated by learning from experiments, initiating change, and utilising people's capabilities (encouraging or allowing things to happen). A similar process based analysis of change is posited by Handy (Op. Cit., p.51), noting that change happens as an experiment succeeds, creating case law, which in turn gains a consensus.

3.16.3 Paechter (Op. Cit., p.77) postulates that when new curricular areas emerge, conflict and fragmentation ensue causing the formation of interest groups. This leads to the Foucauldian position of micro-circulations of power, or micro-politics which can be subject, group or school wide. Skilful management is required to balance the various interest groups and ensure the change is not retarded as a result. However, for Solomon and Hall (Op. Cit., p.275) a succession of imposed National Curriculum Orders in England and Wales were for some practitioners, irrelevant in the sense that they kept on teaching what they believed in. As revised orders were introduced, so they were able to justify their stance. Personal experience now suggests that many experienced colleagues now take the National Curriculum as a framework within which they fit their own good practice, making slight adjustments to ensure adequate statutory coverage.

3.16.4 Satchwell and Duggar (Op. Cit., p.5) note that for all subjects on the school curriculum, the end of the millennium may well signify a change in the core subjects. They suggest that the core of 100 years ago is no longer adequate for preparing capable citizens on their journey into the twenty-first century. In reviewing the original intentions of the Thatcher government toward education, Kay (Op. Cit., pp.39-41) cites the then Education Secretary, Sir Keith Joseph (1985) who visioned a curriculum that was broad, balanced, relevant and differentiated. He spoke of the need to develop individuals and generate wealth for our nation through education. Much the same rhetoric is espoused by 'new' Labour. The slogan 'life-long learning' highlights the need for relevance, flexibility and responsiveness to constantly changing needs. As Kay so poignantly observes:

> "All stakeholders must roam in the secret garden."
> (Ibid., p.41)

In the Galton Report (1997) commissioned by the National Union of Teachers (NUT), Bangs (1997, p.12) attention was drawn to the fact that the school curriculum needs to be flexible enough to respond to the needs of children, both at local and national levels.

3.16.5 Technology education is, according to Hansen and Froelich (Op. Cit., p.192), at the vortex of change in schools. Barnett (1994, p.54) is clear that technological education must focus upon the relationship between technology and change. In reflecting upon the knowledge based approach of the North American 'Technological Literacy' model, as compared to the process driven British model of 'Technological Capability', I can discern that the process driven approach though more difficult to define and assess, does have advantages when it comes to considering the dimensions of change. Technological Literacy identifies 'domains' of knowledge from content, a reliance on such domains might be seen to inhibit change, as cutting-edge technology develops. Lewis (1996, p.234) reflects this belief by suggesting that the 'domains' might 'straight jacket' the curriculum, whereas 'design' offers the freedom to deal with change.

3.16.6 Technological education, as understood by Lang (1997, p.1), is about know-how, using tools, action based, embracing a changing world and being integrative or accessible for all. Newfoundland and Labrador Department of Education (1998a, p.3) note that technological education in evolving from industrial education has evolved strategies to cope with rapid technological change and, in doing so, has proven able to develop appropriate technological solutions to a range of needs and wants.

3.16.7 A final thought on technological education, change and capability is offered by Banks (1997, p.55). In order to embrace the challenges offered or posed by the technology curriculum teachers need to be role models in the move toward life-long learning. He suggests also that variety and flexibility in terms of how teachers organise teams to deliver the curriculum, would more closely mirror how flexible pupils will need to be, to meet future needs of society and individuals.

3.16.8 As with issues of leadership ~ section 3.15.5, my philosophy regarding the management of change continues to evolve and shape my practice. The writing up of my Investigation has helped to crystallise my thoughts, but section 6.6.4 indicates how my philosophies of leadership and managing change interleave and how they have begun to evolve in tandem.

3.17 Conclusions

3.17.1 The level of language use I have been exposed to during the Ed.D. course has washed over me until I have been able to utilise many of the associated complex thought processes and concepts to develop my own understanding of technological capability to a much higher level.

3.17.2 This chapter has enabled me to explore and reflect upon education more deeply than I have had cause to in the past. As such I feel to be better equipped to tackle philosophical questions pertaining to education, and in particular technology education, than was previously the case.

3.17.3 An international perspective on 'Technology Education' enabled an exploration of the terms 'technological capability' and 'technological literacy' to be fully explored, contrasted and contemplated.

3.17.4 I felt that utilising articles by practitioners, and actively seeking the views of 'classroom teachers' brought a depth to this chapter that would not be attainable from a literature review alone.

3.17.5 Exploring seven 'emergent' facets of technology education that I feel shape the subject of 'Design and Technology', was both exhausting and exhilarating. I was not personally conscious of these multi-dimensions of technological education prior to researching and writing this chapter.

3.17.6 Using the themes of 'leadership' and 'change', I have been able to build explicitly upon the taught modules of the doctoral course, and interleave active research with theory and experience to broaden my management experiences and perceptions.

3.18 Reflections

3.18.1 This chapter has provided a tangible depth to both my philosophy of technology education, and also to education, as I now perceive it, in more general terms. It is unexpected, but the latter now feels as important as the former. This was not my feeling prior to commencing the doctoral journey.

3.18.2 I feel more capable, but this is for others to judge.

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

CHAPTER 4

METHODOLOGY

"WE HAVE NO ART, WE JUST DO THINGS AS WELL AS WE CAN"

BALINESE PROVERB

1999 KEITH ATKINSON

4.0 Methodology

4.0.1 This chapter explores methodology, charting the author's development from being a statistically inclined mathematician to the broadening out of a perception of research as being an eclectic mixture of both qualitative and quantitative methods, rooted in context and unique to each research question being addressed.

4.0.2 The effects of the interplay between the taught doctoral module, 'Research Methods in a Dynamic Context', and experience from professional practice as an educator are reflected upon as having impacted on my own professional development.

4.0.3 The Aims of this Chapter are:

- To describe the preparatory work undertaken during the taught modules of the Nottingham Trent University taught Doctorate in Education, and the effect upon this Research Investigation.

- To build upon the work done in the introductory chapter on Research Methodology ~ see section 1.4, exploring the theoretical background to the choice of research methodology.

- To guide the reader through my own interpretation of 'Action Research' as applied in this work.

- To describe the application of the Action Research 'Cycles' to this specific Research Investigation.

  - Cycle 1 to include:

    How the first 'Research Instrument' was designed.

  - Cycle 2 to include:

    How the 'Taped Interviews' evolved from the work in 'Cycle 1', including further reading and reflection.

- describe how the data was captured.

- analyse the process of 'Data Analysis'.

- describe and justify which data analysis techniques were deployed.

- explain how the data reduction occurred.

4.1 Preparatory Work

4.1.1 As indicated in sections 1.1.1 and 4.0.1, I am a mathematician by orientation, having faith only in quantitative research methods prior to enrolling on the taught doctoral programme. According to Ely (1991), this is not unusual:

> "…we have all been educated within the positivist paradigm, and most of us come to the naturalistic paradigm formed by many years of intellectual discipline."
> (p.182)

'Positivist' and 'Interpretive' paradigms are discussed by Robson (Op. Cit., p.18) and Cohen and Manion (Op. Cit., p.36).

4.1.2 Reflecting upon why I have chosen Action Research as my methodological base from which to explore technological capability, I have been moved to perceive research methods as context specific and a good deal more 'messy' than was previously the case. Having read widely over the past three years, Bell (Op. Cit.) typifies texts that have helped to shape my change of perception:

> "Researchers adopting a qualitative perspective are more concerned to understand individual's perceptions of the world. They seek insight rather than statistical analysis. They doubt whether social 'facts' exist and question whether a 'scientific' approach can be used when dealing with human beings."
> (p.6)

4.1.3 The taught doctorate has moved my perception of a model of research methods away from a polarised linear model, as in Figure 4.1 below:

Quantitative ⟷ Qualitative
'Measured' 'Loose'
'Proper' 'Dubious'

Figure 4.1

towards a 'rat's nest' analogy, where various methods overlap, curl back upon themselves and become closely intertwined, making a 'messy' or 'lumpy' model of eclecticism. This conceptualisation is far removed from the simplistic, rather clinical model I had envisioned previously. As Bell (Ibid. p.6) observes:

> "Classifying an approach as quantitative or qualitative, ethnographic, survey, action research or whatever, does not mean that once an approach has been selected, the researcher may not move from the methods normally associated with that style."

This reflects the recognition by Ely et al (1991) that:

> "...the great majority of topics for study and research questions do not arise out of a vacuum or specious choice but, instead, mesh intimately with researchers' deepest professional and social commitments." (p.30)

4.1.4 I had previously appeared to suppress the notion that I as a teacher could conduct research of any merit whilst 'holding down' a full time job. A direct benefit of working at doctoral level has been the acquisition of self-confidence to felt able to trust oneself. Ely et al (Ibid.) suggest it is a case of:

> "...learning to trust the research paradigm itself, to accept that it is worthy and respectable, and learning to trust oneself as a flexible instrument." (p.32)

4.1.5 As a teacher of design and technology I felt most confident in encouraging children to both research and evaluate, as natural stages in a 'design process'. I had not made the link between educational research, evaluation and change. Robson (Op. Cit., pp.6-7) provided me with an opportunity to make this connection and my emergent thoughts on methodology were further clarified by Robson's Box 1.1 on pp.11-12 in the same text characterising 'real world enquiry', as did Box 1.2 in

Cohen and Manion (Op. Cit., p.10) concerning 'conceptions of social reality'.

4.1.6 Feeling confident enough to undertake this Research Investigation, I engaged fully with research methodology. The following section charts my personal navigation through the relevant methods.

4.2 Further discussion of Research Paradigms and the development of my chosen Research Methodology

4.2.1 The growing eclecticism with which I came to conceptualise research methodology was obliquely referred to in the Doctorate in Education course details:

> "Certain major assessments will reflect involvement in change and in complex problem based contexts, as opposed for example, to a focus on a single hypothesis… the content, organisation and assessment will each simultaneously engage with praxis, vision, change and communication." (TNTU p.2)

Although initially daunting, I came to visualise the taught doctorate as a postmodernist course, with uncertainty being a feature, causing participants to manage change as an ongoing requirement. Having widened my perception of research methodology, such visualisation was less threatening to me personally, having been exposed to a naturalistic as well as positivistic research paradigm.

4.2.2 In electing to operate within an Action Research paradigm, I used six characteristics of qualitative research from Ely et al (1991, p.4) as confirmation that my Investigation could be located with legitimacy. Ely characterises qualitative work as:

- understood adequately only if viewed in context

- the context of enquiry being natural and not contrived, nothing taken for granted
- it is an interactive process, with the subjects teaching the researcher
- the whole experience is attended to in a unified manner
- there is no one general method
- the process may entail appraisal of what was studied

Having decided that context specificity was central to the Investigation, and that I should attempt to visit schools in rural and suburban locations, the first two bullit points above were viewed as central to my work. The course required myself to conduct the research; the research was to form part of a unified or holistic doctoral journey. Bullit points three and four were also central to my doctoral work. The final two points, acknowledging the utilisation of several research methods, along with integral reflective appraisal, were important in enabling me to view qualitative methodology as the most legitimate way to progress my work, from a personal perspective.

4.2.3 Having issued a questionnaire as part of action research cycle 1, I was reflecting upon the findings when I re-read Chapter 6 of Ely et al (1991). Concerning the role of reflection in qualitative research they refer to five overarching 'meta-themes'. In summary these are:

- learning by doing can be a powerful process
- research-practitioners remain open to change as a way of life
- qualitative research processes also impact upon professional growth
- ethical concerns are woven through every step of the research

I found these themes provided for a timely crystallisation of my thoughts, I began to realise that far from being an easy option, my chosen methodology proved to be intense and, both consciously and sub-consciously, riven with checks and balances in my quest to obtain an accurate audit.

4.2.4 As mentioned in section 1.4.12, time compression prevented me from using Personal Construct Theory as a method in this Investigation. An observation about Kelly, made by Zuber-Skerritt (1992, p.58), positing that all humans are 'personal scientists, engaged in observation, interpretation, prediction and control', helped me to determine the shape of my action research cycle two. This centred around visiting the staff and students who filled out the questionnaires from action research cycle one in their schools, to both clarify some responses, and probe more deeply emergent questions from student and staff responses as well as developing my ideas from intervening reflection and reading.

4.2.5 The above notion of Action Research cycles as plan, act, observe, reflect, revised plan, etc. I gleaned from Zuber-Skerritt (Ibid., p.13) and builds upon the work of Kolb ~ see 2.3.46, with which I was familiar from my literature review. I perceived a direct link with the reading I had done on the Bruner 'spiral curriculum' and also the Montgomery 'Cognitive Learning Process Cycle' ~ also see 2.3.45.

4.2.6 Zuber-Skerritt (Ibid., p.14) quotes a working definition of action research as:

- people reflecting and improving their own work in their own situations
- tightly interlinking reflection and action
- making their work public to other interested parties
- data gathering by participants in relation to their own questions
- participation in decision making
- power-sharing in a non-hierarchical manner
- collaboration within a 'critical community'
- self-reflection, self-evaluation and self-management
- learning progressively by doing and making mistakes in a 'self-reflective spiral' of planning, acting, observing, reflecting, replanning, etc.

- reflection which supports reflective practice

This provided clarity and encouraged belief within myself that my doctoral Investigation would interleave quite naturally with action research. By way of cross-reference, McNiff et al (Op. Cit., pp.15-18) appeared to confirm the suitability of action research to my investigation, by quoting action research as something that:

- requires action as an integral part of the research process itself
- is focused by the researcher's professional values
- is insider research, researching one's own professional actions
- leads to knowledge
- provides evidence to support knowledge
- makes explicit the process through which knowledge emerges
- links new knowledge with existing knowledge
- is informed, committed and intentional

4.2.7 Having committed myself fully to Action Research as my methodology, I indicated that two of the instruments I used to gather data were questionnaire (Cycle 1) and taped interview (Cycle 2). A third method I felt was appropriate and relevant was the use of 'Vignette', as I worked to quite a tight time scale, the work being 'developmental in flavour' and appearing to lend itself to a 'snapshot' approach. As I intended to concentrate on two schools, one rural and one suburban, I felt that this Investigation would benefit from each school being the subject of a vignette, to contextualise the data gained from my two action research cycles within the two schools.

4.2.8 I first became aware of the use of vignettes as a research tool in an article by Salloum (1996, pp.425-434), read as part of the taught module on the 'Management of Change' during year 1 of the Ed. D. course.

Both Miles and Huberman (1994, pp.81-83) and Bowen (1999a, p.4.4) were influential in my interpretation of vignette, Bowen suggesting there are type 1 (paraphrased narrative) and type 2 (direct quotation from raw data) examples. Miles and Huberman (Op. Cit., p.81) suggest that :

> "A *vignette* is a focused description of a series of events taken to be representative, typical or emblematic in the case".

4.2.9 I felt that vignette would enhance the Investigation by adding contextual remarks, and also add legitimacy to the analysis and verification by providing references to raw data or summative commentary on student (and staff) dialogue and interaction. As Ely (1991) suggests:

> "Sharing vignettes ….. that contain the words and actions of the people we study makes qualitative reports come alive."
> (p.25)

Whilst it would be presumptuous to suggest I could make my own work 'come alive' I do feel that vignette is a method that, along with questionnaire and taped interview have enhanced this particular Investigation.

4.2.10 Having reflected at length, over a number of months, the following section charts 'how' I actioned my philosophical beliefs in this specific Investigation.

4.3 Developing the Research Design

4.3.1 The first stage of this research design can be pinpointed back to 1988, and the publication of the first Standing Orders for National Curriculum Technology in England and Wales. I remember being enthralled with the notion of technological capability, and thought at the time that I must endeavour to arrive at a personal definition that I could both comprehend easily and work within. In 1988 I perhaps thought it should 'sum up' in some way my beliefs about technology education.

4.3.2 Elements of this research design have been alluded to in the previous section, specifically the use of questionnaire and taped interview, as they form such a central rôle in the data capture process of this specific Investigation.

4.3.3 The design of the questionnaire proved to be a lengthy process, with several drafts, redrafts and pilots. The theoretical underpinning of the use of questionnaire is located within the work of McNiff (Op. Cit., pp.98-100) and Robson (Op. Cit., pp.49-51).

4.3.4 Mc Niff (Op. Cit., p.98) suggests that questionnaires should only be used within an action research paradigm if the basic information cannot be ascertained otherwise. As a full time teacher, undertaking a part-time doctorate, travelling to both rural and suburban schools, the use of questionnaire was felt to be appropriate. It enabled me to meet the sample of students within their context, and capture the data in a 'snapshot'; it also helped to explain or clarify any points of ambiguity at the time of questionnaire completion during Action Research Cycle 1.

4.3.5 Robson (Op. Cit.) suggests that questionnaire falls within the wider methodology he calls 'Survey Methodology', the general characteristics of which include:

> "a relatively small amount of information is collected from any one individual, contrasting with case study, where a great deal of information might be obtained from a 'key informant'. There is normally no attempt to manipulate variables or control conditions, as would be the case in experimentation. Surveys are well suited to descriptive studies where the interest is, say, in how many people in a given population possess a particular... opinion...Surveys are often CROSS-SECTIONAL STUDIES. That is, the focus is on the make-up of the sample, and the state of affairs in the population at just one time. The value of this kind of 'snap-shot' approach depends crucially on choosing a representative, non-biased sample."
> (p.49)

Given my comments about the developmental nature of this Investigation ~ see 1.02, I posit that the declaration suggesting findings will not lay claim to generalisability makes survey techniques relevant to this Investigation.

4.3.6 Given I was drawing a sample from 'A' level Design and Technology students, I decided to use a technique Cohen and Manion (Op. Cit., pp.88-89) describe as 'Non-probability' 'Purposive sampling'. They characterise this technique as:

> "despite the disadvantages that arise from their non-representativeness, they... can prove perfectly adequate where researchers do not intend to generalise their findings beyond the sample in question... In purposive sampling, researchers hand pick the cases to be included in the sample on the basis of their judgement of their typicality. In this way they build up a sample that is satisfactory to their specific needs."

4.3.7 Having decided to use a questionnaire, and to administer it to a 'purposive sample' I designed a ten page (A4) instrument that incorporated a range of question types and layouts. The texts that were influential in its design were, in order of personal influence, Bell (Op. Cit., pp.76-82), Robson (Op. Cit., pp.243-267), Box 4.4 in Cohen and Manion (Op. Cit., p.95) and McNiff (Op. Cit., p.99). I carried out two pilots of the instrument, reading further and refining the instrument on each occasion, to finally end up with the version that is included in Appendices 4.1 and 4.2. Student and staff questionnaires were produced, based around the same types of question, with a small number of variations ~ see Appendices 4.1 and 4.2.

4.3.8 It was the declared intention to follow up the completed questionnaires during action research cycle 1 by further reading and reflection, and to interview the staff and students who participated in Cycle 1, to clarify and develop emergent key characteristics. Hence taped interview was to be the main research instrument used during Action Research Cycle 2.

4.3.9 According to Robson (Op. Cit.):

> "The interview is a flexible and adaptable way of finding things out. The human use of language is fascinating both as behaviour in its own right, and for the virtually unique window that it opens on what lies behind our actions... Face-to-face interviews offer the possibility of modifying one's line of enquiry, following up interesting responses and investigating underlying motives in a way that postal and other self-administered questionnaires cannot."
> (p.229)

After analysing the responses from the first action research cycle ~ see 5.4.10, and reading further about technological capability, I felt the need to explore further some interesting responses, both where general agreement appeared to exist, and also where differences seemed to occur.

4.3.10 I read many texts that highlighted different types of interview, typically as 'structured', 'semi-structured' and 'unstructured' ~ see Bell (Op. Cit., p.93), Robson (Op. Cit., pp.230-231) and McNiff (Op. Cit., p.101). Given that I had already established contact with the sample groups by a formal questionnaire, I did not want the follow up interview to impose the same sort of rigid formality, particularly as I wanted to probe and tease out some of the topics covered during Cycle 1. I also rejected the idea of a completely informal interview, due to the difficulty of recording and utilising the responses given, without recourse to an overall structure of the interview.

4.3.11 I opted to use a semi-structured format to the interviews, using a 'Data Capture Form', a copy of which is located in Appendix 4.3. I felt that this would enable me to ease the interview along within a framework that covered all of the areas I wished to probe, yet still allow interviewees to respond fully to issues being discussed, perhaps following a line of .

thought that I had not expected, or that came out of personal conviction of the interviewee.

4.3.12 In choosing to record the interviews on audio tape, I had reflected on the views of Ely et al (Op. Cit., pp.82-83) and McNiff (p.104) who suggest that taping adds interesting dimensions to the research data, allowing for reflection and evaluation to occur at the human level, through repeated replaying and clarification of human interaction. I was mindful of the potential benefit that this humanist dimension could inject into my research.

4.3.13 In electing not to transcribe the interviews, I was aware of the potential reduction in legitimacy or verifiability that such an approach would necessarily create. However, given the nature of this specific Research Investigation, and the effects of a compression of time that I have alluded to elsewhere ~ see 1.3.10 concerning 'Research Question 5', I decided early on in the planning phase of Action Research Cycle 2 that I would not transcribe taped conversations. I did make use of the advice given by my supervisor to keep a close eye on the tape counter and note when and where significant points were raised, to aide tracking and verification at a later date. This subsequently proved to be valuable advice.

4.3.14 My quantitative mathematical conscience reared its head during the research design phase. I was conscious that in electing to use 'purposive sampling' in Cycle 1, and not transcribing taped interviews during Cycle 2, there was a potential problem regarding verification, even though the research was explicitly making no claim to being generalisable. I had personal difficulty in leaving the data to personal scrutiny by myself only. I therefore deliberately built a section into the taped interviews (Cycle 2) where I triangulated back to the student sample, what responses had given rise to general agreement, and which had thrown up the possibility of disagreement. I then invited students to comment upon the findings, as a purposive mechanism of data verification, in terms of accuracy.

4.3.15 My understanding of the concept of 'triangulation' was shaped by the work of Ely et al (Op. Cit., p.98), Robson (Op. Cit.,pp.290, 383 & 404), McNiff (Op. Cit., p.78) Miles and Huberman (Op. Cit., p.11) and Cohen and Manion (Op. Cit., pp.233-251). In particular I opted to use 'Methodological Triangulation' as defined by Denzin (1970) in: Cohen and Manion (Op. Cit., p.236).

4.3.16 In addition to data analysis resulting from the questionnaire issued during Cycle 1 and the taped interviews during Cycle 2, I also collected various documents from both schools, including departmental handbooks, schemes of work and school brochures, all of which are available for inspection. These do not feature in the appendices as they would provide easy identification of participating schools as they make extensive reference to the school identity throughout the documents. In making reference to such '*primary sources*' of documentary evidence I drew on the work of Bell (Op. Cit., pp.68-74) as well as my experience of 'deconstruction' as covered during the taught doctoral module of 'Research Methods in a Dynamic Context' (July 1997) of Year 2 of the course.

4.3.17 In carrying out an analysis of the above documents I was mindful of the need to look at issues relating to '*External Criticism*', trying to establish whether documents were genuine and authentic. Also I looked at '*Internal Criticism*', as outlined above, mainly by a Derrida type 'deconstruction' process.

4.3.18 A final element of the research design involved my own personal thoughts and reflections that were a feature of the reflective phases of each of the action research cycles. My 'journals' that had been kept from September 1996 at the start of the doctoral journey, contain my emerging thoughts and feelings regarding all elements of the taught doctorate, as well as commentary on my research activities. I made extensive use of the journals, especially when things did not 'go well' or 'to plan'. This was a carthartic process, with me personally feeling as though I retreated into my journal to 'lick my wounds' or seek solace in my own 'safe haven' of private thoughts and jottings.

4.3.19 Having navigated the reader through the process of my research design it is the intention to look at how the analysis was conceptualised. An important feature of the research design was to acknowledge the comment by Ely et al (Op. Cit., p.86) that data analysis is an ongoing, intertwined process occurring throughout a research project.

4.4 An analysis of Analysis

4.4.1 In reflecting upon methodological considerations of data analysis, I intend to explore issues relating to overarching principles, general characteristics, mechanisms used, and trust or verifiability.

4.4.2 Robson (Op. Cit., p.306) contends that analysis is not 'an empty ritual', explaining that it is not an after thought or optional extra to be considered once the data has been captured. He postulates that 'how analysis may be expedited' forms an important part of any investigation at an early stage. McNiff et al (Op. Cit., p.18) describe analysis as:

> "systematic monitoring to generate valid data"

4.4.3 Miles and Huberman (Op. Cit., p.12) suggest that there are three main approaches to qualitative data analysis:

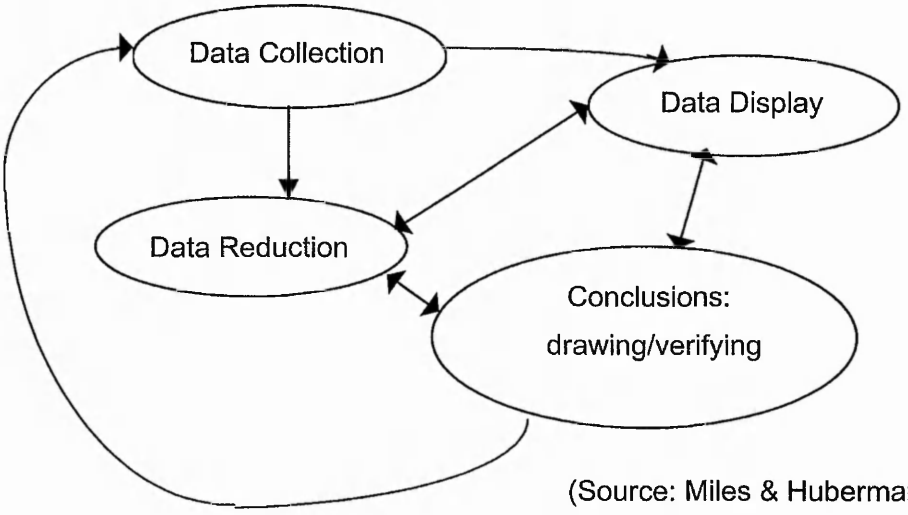
- Interpretivism ~ rooted in phenomenology, semiotics and ethnomethodology
- Social Anthropology ~ ethnographically based, including grounded theorists

- Collaborative Social Research ~ based on social setting to include action research

Interpretivism uses 'text' interpretation to make sense of social interaction. Social Anthropology makes extensive use of case study to define behavioural patterns in everyday situations. Collaborative Social Research requires the researcher to assume an active central role in the research process, in which data analysis is an ongoing and intrinsic part. The latter approach is the one I adopted, seeking to us data analysis to improve personal understanding and, by implication as a teacher-researcher, personal professional practice.

4.4.4 Miles and Huberman (Ibid., p.12) go on to suggest that there are components of data analysis that are common to each of the above methods. Their 'Interactive Model' is shown in Figure 4.2:

Components of Data Analysis: Interactive Model



(Source: Miles & Huberman p.12)

Figure 4.2

Cyclical and iterative in nature, it gives a strong feeling of continuity and involvement, reinforcing the notion that analysis is present at the start and throughout the process. This diagram was influential upon my evolving perception of the role of analysis in this Investigation.

4.4.5 Regarding mechanics of the physical analysis of data, Robson (Op. Cit., p.372) builds upon the work of Tesch (1990) suggesting that analysis is concerned with the following grouping of approaches:

- characteristics of language
- discovery of regularities
- comprehension of meaning of text or action
- reflection

Given that my research question was focused around an investigation into regularity, trying to establish 'if the acquisition of technological capability was uniform within rural and suburban contexts', on a personal level I came to regard analysis of questionnaire data ostensibly as 'combing'; looking for examples of similarity and difference in response across quite a wide range of questions.

4.4.6 Yin (Op. Cit., p.103) suggests that case studies make use of various analytic techniques, including:

- Putting information into different arrays
- Making a matrix of categories and ascribing information to each category
- Creating data displays as a means to examine data
- Tabulating the frequency of different events
- Examining tabulation complexity by second-order numbers such as means and variances
- Putting information in chronological order using other temporal schemes

As indicated earlier in this chapter the eclectic nature of my methodology is carried through to my data analysis, and although Yin's work relates to case study, there are elements of the above list that I saw as relevant or applicable to my work.

4.4.7 When designing my questionnaire for use in Cycle 1, I was mindful as to how I could lay the data out clearly to be able to discern important trends. The work of Yin (Ibid., p.103) enabled me to utilise putting information into 2D arrays, displaying graphically trends of agreement or variance, thereby being able to discern event frequency. The next section on data reduction will expand upon the use made of these techniques.

4.4.8 When considering the analysis of interviews, Miles and Huberman (Op. Cit., p.9) also provide a similar sequence of 'classic analytic moves':

- affix codes to field notes from interviews
- note reflections and remarks in margins
- sort and sift through the materials for similarities or patterns
- isolate the patterns and processes, removing them from the next cycle
- gradually elaborate generalizations that cover consistencies
- confront the generalizations with a formalized body of knowledge to construct theories

As I had made explicit from the outset of the Investigation that I intended not to make a claim to generalizability, the latter three points were beyond the scope of my current work. However, the first three were useful as considerations when I came to both conduct the interviews and make subsequent notes.

4.4.9 By way of summary, Robson (Op. Cit., pp.377-384) draws together the work of many authors in synthesising seven *'basic rules'* for dealing with qualitative data:

- analysis should start as soon as the data is collected
- keep tabs on what is collected ~ index it
- generate themes, categories, codes, include, don't exclude
- think and reflect, don't be mechanical
- play with the data ~ sort and resort and file
- there is no 'right' way to analyse the data, be systematic and persevere
- the main tool is comparison, seek to take the data apart in various ways and then put it back together to consolidate it

followed by eight *'general strategies'* for analysis:

- Basing the analysis on Theoretical Propositions
- Basing the analysis on a Descriptive Framework
- Exploring the Data
- Explanation-building
- Chronologies
- Time Series Analysis
- Triangulation
- Key Events

4.4.10 I subsequently found the 'basic rules' to be of great benefit as guiding principles, finding that other researchers with whom I discussed my work adopted various combinations of these rules. In terms of 'general strategies' my approach was one of 'Exploring the Data', both informally (whilst still directly involved) and formally (afterwards). Although I aspired to 'Triangulation', both the quantity and variety of data capture techniques did not seem to make this a viable proposition. I did utilise the concept of data triangulation for verification, by feeding back results of Cycle 1 questionnaires during the taped interviews in Cycle 2 ~ see 4.3.15.

4.4.11 In drawing the section to a close I feel obligated to discuss issues of trust. As a practitioner-researcher I noted with interest the observation of Robson (Ibid. p.374) in making explicit the possible deficiencies of the human as analyst. This links with issues to do with trustworthiness, such as: credibility, transferability, dependability and confirmability as discussed in Miles and Huberman (Op. Cit., pp.278-279) and Robson (Op. Cit., pp.402-406).

4.4.12 Thoughts on legitimacy were recurrent. Having defined my practice as being values led ~ see 1.2.3, and also providing a contextual backdrop by providing thought on values in Chapter 2 ~ see 2.2.77, I reflected throughout the process of data analysis, constantly questioning whether each stage was 'honest' or convincing to myself. This was not a comfortable process for a convert from the 'solely quantitative' tradition.

4.4.13 Having looked at analysis in some detail, the next stage of my Investigation involved a consideration of issues surrounding the notion of data reduction, both philosophical and practical.

4.5 Data Reduction

4.5.1 In providing tactics for generating meaning, Miles and Huberman (Op. Cit., pp.245-246) provide an overview of approaches the move from the descriptive to the explanatory:

Descriptive ↑

1. Noting Patterns and/or Themes
2. Seeing Plausibility
3. Clustering
4. Making Metaphors
5. Counting
6. Making Contrasts/Comparisons
7. Partitioning Variables
8. Subsuming the Particulars into the General
9. Factoring
10. Noting relations between Variables
11. Finding Intervening Variables
12. Building a Logical Chain of Evidence
13. Making Conceptual/Theoretical Coherence

↓ Explanatory

4.5.2 This Investigation centered around noting patterns and themes, seeing plausibility and clustering. Miles and Huberman (Ibid., p.246) suggest that when working with text, *'gestalts'* or recurring themes pull together many separate pieces of data. In looking at possible 'specific characteristics' of 'technological capability', I made extensive use of displaying data in 2D arrays to try and discern trends visually. I then developed this into a notion of '*plausibility*' (Miles and Huberman Op. Cit., p246), acting as a '*pointer*', drawing attention to a conclusion that looked sensible 'on the face of it'.

4.5.3 Attempts to '*cluster*' my findings into '*cogent groups'* or 'traits' to define 'technological capability' helped shape some of the content of the taped interviews during Cycle 2. If I were to extend the study into a third cycle the next stage could possibly involve an iterative process of matrix production to try and begin to partition variables. It is readily acknowledged that to do this meaningfully the size of sample would need to be increased to provide a firmer basis on which to try and build such processes.

4.5.4 In reality, given the timescale of the Investigation my reduction largely stopped at the level of 'noting patterns and themes', as befitted the acceptance that the conclusions of this Investigation would not lay claim to generalizability. I did attempt a reduction of the specific characteristics of D&T from the Questionnaire in Acton Research Cycle 1 ~ see 5.4.36.

4.5.5 In considering approaches to legitimise or confirm findings, I again made extensive use of Miles and Huberman (Ibid., pp.262-276). I was mindful throughout the Investigation of the danger of trying to discern patterns in the data where there perhaps were none. I was also conscious my sample contained only 'A' Level students, and as such might be subject to 'elite bias' of highly articulate students. A final concern was of being 'co-opted' into the explanations of the student sample, particularly as a practitioner-researcher of the subject I was investigating.

4.5.6 In an attempt to question in a rigorous manner my findings I made use of thirteen tactics suggested by Miles and Huberman (Op. Cit., p.263). In a non-hierarchy these were:

- Checking for representativeness
- Checking for researcher effects
- Triangulating
- Weighting the evidence
- Checking the meaning of outliers *
- Using extreme cases*
- Following up surprises*
- Looking for negative evidence*
- Making 'If-then' tests

- Ruling out spurious relations
- Replicating a finding
- Checking out rival explanations

and

- Getting feedback from informants

* = *concerned with looking at 'unpatterns', or what a pattern is not like.*

4.5.7 Many of the above have been alluded to in this methodology chapter, and where possible I have attempted to consciously reflect upon the above at every stage of data handling, from capture through to reduction.

4.6 Conclusions

4.6.1 Having discussed the possibility that research was 'lumpy and messy', I found that it was more so than I had contemplated. The pressures of a full-time post exacerbated the messiness, but it felt more genuine and honest than any research I had previously done before. I felt a strong analogy with my previous experience as a hooker in a rugby team. Some of the best and most memorable of games were in the middle of winter on muddy pitches. It perhaps didn't feel good at the time, but in hindsight the experiences became indelible on the mind.

4.6.2 The Miles and Huberman (Op. Cit., p.10) Data Flow Model which suggests that data manipulation starts early on in the cycle of data collection, and often continues beyond the writing up stage, has proven to hold true in this particular Investigation. There has been no clear starting point, or finishing point.

4.6.3 Personally I have found the research process to be both frustrating and absorbing, and feel that at the end of the process that the journey has been as informative as the end product. I feel I have 'grown' with the work, and would hope that this feeling comes across in the writing up of my work.

4.6.4 The methods of data collection have been eclectic, as have the methods used to reduce the data sets. This comes from lively and active taught doctoral sessions, and also extensive personal reading of 'qualitative' methods and methodologies.

4.6.5 It is hoped that the methodologies used can be understood by the reader, as having evolved in part from the content and philosophical stances adopted during the exploration and synthesis that resulted in the shape and content of Chapters 2 and 3.

4.7 Reflections

4.7.1 This Chapter is a testament to the change that has been effected in me by participating actively as a practitioner-researcher on the doctoral course. I am an unashamed convert to qualitative research methodologies.

4.7.2 This Chapter (hopefully) reflects the developmental thrust of the Ed.D., as opposed to the traditional Ph.D., with its 'claim to knowledge'.

4.7.3 The exploration of literature, and researching in school contexts, felt complimentary to each other, as intended, and gave a satisfying feel of philosophical enquiry being probed 'in situ'.

4.7.4 The data has been organised, archived and is readily available for scrutiny. This proved to be much more complicated than originally envisaged.

4.7.5 The eclectic data collection methods used reflects the wide reading done on research methods.

4.7.6 The research tools were trialled and remain auditable.

4.7.7 The valuable help given by critical friends and fellow course members must be acknowledged.

4.7.8 The 'themes' that emerged did so from the findings/matrices of both 'Action Research Cycles'.

4.7.9 Vignettes were used to briefly explain each of the schools used in the data collection process.

4.7.10 Time constraints were omnipresent, but a pragmatic approach was adopted to minimise the negative effects of the overall course structure and tight time lines.

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

CHAPTER 5

ANALYSIS

"SOME PEOPLE SEE THINGS AS THEY ARE AND SAY 'WHY'? I DREAM THINGS THAT NEVER WERE AND ASK 'WHY NOT'?"

ROBERT FITZGERELD KENNEDY 1968

1999 KEITH ATKINSON

5.0 Analysis

5.0.1 This chapter acknowledges the developmental flavour of the work, as required in the course regulations for the award of Doctorate in Education at The Nottingham Trent University. The methodology outlined in Chapter 4 is utilised and reflected upon. I was able to clarify what I regarded as key features of 'Technological Capability' as discerned by students and teachers of 'A' level Design and Technology in suburban and rural schools. As outlined in Chapter 1, I view the work as a gateway to a more substantive piece of research. As indicated in the previous chapter ~ see section 4.5, I discuss the findings in terms of how they emerged as groupings.

5.0.2 The Aims of this Chapter are:

- To make explicit my own values and emergent views as they relate to the processes of research and analysis.
- To highlight explicit influences relating to the interpretation of analysis of the contexts of the schools in which I conducted the research.
- To comment on issues surrounding the implicit interplay between the various aspects of the Ed.D. course, and this Research Investigation:

Taught Modules

- Management of Change
- Research Methods in a Dynamic Context
- Ways of Seeing ~ Theories, Models and Perspectives

- To reflect upon my own 'personal growth' as a teacher-researcher.

- To comment upon the data as it emerged from the Action Research Cycles.

- To discuss the 'Plausibility' ~ see 4.5.2, of creating 'Clusters' ~ see 4.5.3, of *general characteristics* to generate 'Pointers' ~ see 4.5.2, as an *aide memoir* to describing the notion of Technological Capability.

- To explore 'new understandings' that I gained into 'technological capability' as an individual at the centre of this Research Investigation.

- To review the' doctoral journey', as it nears an end, having begun in September 1996, with specific reference to the impact upon this particular Investigation.

5.1 Overarching View

5.1.1 In Chapter 4, and at various other points throughout this Investigation, I, have made clear that extrapolation of the data would not be applicable, due to the small sample size. The work does provide a 'gateway' through which a larger piece of qualitative research could be undertaken.

5.1.2 In section 4.2.9, I drew attention to my justification of the use of vignettes as being to enable the reader to engage with the data from a clearer contextual perspective. In the vignettes I refer to quotations made by students or staff, or both, to justify any findings that I personally feel to be 'plausible'.

5.2 Explicit Influences

- 5.2.1 ~ General Influences
- 5.2.2 ~ Issues Related to Choice of School

5.2.1 GENERAL INFLUENCES

5.2.2 In Chapter 2 ~ see 2.1, I made reference to the developments in design and technological education over the past decade, back to 1988, from a personal perspective.

5.2.3 The values that provide the backdrop for my own personal educational philosophy were also made explicit in section 2.2.77. To contrast my position now, compared to that prior to undertaking doctoral studies, please refer to Chapter 6 ~ sections 6.1, 6.6, 6.9 and 6.10.

5.2.4 On a personal note, I found it regretful that, seemingly as a result of the publication of league tables with the implicit 'local' comparison of schools, there was resistance to some schools within the same Local Education Authority, to allow themselves to participate in research projects aimed at improving understanding. My choice of schools eventually led me to select two schools from different LEA's.

5.2.5 ISSUES RELATED TO CHOICE OF SCHOOL

5.2.6 Both of the schools selected were English, one of the schools selected was located on the outskirts of a large city in the Midlands, the other serving a small rural community in the North.

5.2.7 Both schools offered Design and Technology at 'A' Level, with annual uptake in both schools being consistently in single figures, typically being between 4 and 9 in number.

5.2.8 Available in my archive I have school prospectuses, departmental handbooks and departmental schemes of work from both of the participating schools.

5.3 Vignettes

5.3.1 For a discussion on the types and uses of vignettes refer to sections 4.2.7- 4.2.9.

5.3.2 'RURALIS' SCHOOL

5.3.3 With approximately 1100 pupils on roll, the school had only seven children from ethnic minorities or mixed race background, as indicated by the teacher suggesting:

"you could count the number of non-white students on one hand" (School R1,Teacher JS, Tape1 Side1, Counter ***)

It can be heard on the tape that the teacher and seven students proceeded to name all of the children with relative ease. During these taped conversations it was evident to me that race did not appear to be an issue of contention in the school, the care and respect with which the students treated each other was a striking feature of an ordered and purposeful learning community.

5.3.4 In probing the group as to whether they did work to embrace different cultures and races, the students referred to both work within the curriculum generally and also within design and technology. One student (School R1, Student MJA, Tape 1 Side 1, Counter ***-***) recalled visiting the Bradford 'Interfaith' centre and completing a Key Stage 3 food project as a result of the experience. When questioned whether or not this was an annual event, the teacher (School R1, Teacher JS, Tape 1 Side 1, Counter ***) indicated that the project had not run in the intervening three years, since 1996.

5.3.5 'Ruralis' school's curriculum delivery management was via 'Faculties', with Design and Technology being included within the 'Design' Faculty. This faculty included the former areas of 'Craft Design and Technology' and 'Home Economics', along with 'Art and Design'. At GCSE level students chose to do either 'Design and

Technology: Food', 'Design and Technology: Textiles' or 'Design and Technology: Resistant Materials'.

5.3.6 'SUBURBIA' SCHOOL

5.3.7 This school was in the suburbs of a large Midlands city, being a church school containing 870 students. By contrast to the 'Ruralis' School there were children from 27 different nationalities, and there were upwards of 15% of children from black, Asian or mixed race families. Of the white children there was a significant proportion of children from second generation Irish, Italian and Polish families. As with the participating rural school, the ethos of care, respect and tolerance was prevalent, within a calm and purposeful environment.

5.3.8 For clarification, in the taped interviews of Cycle 2 I asked the question whether facets of other cultures were considered, to encourage cultural tolerance. All responded by insisting that the school's policy on equal opportunities (displayed prominently in each room on 3 laminated A3 posters) enjoyed the support of nearly all of the pupils. The students did not feel it necessary to address different cultures through design and technological projects, as it was an issue that was covered in most subjects. One student remarked:

"It just isn't a problem, we have all grown up surrounded by children from lots of different cultures"
(School S1, Student IJ, Tape 1, Side 1, Counter ***)

The respondent was Italian-English, with one of the other students in the 'Suburbia' School sample being French-English.

5.3.9 In 'Suburbia' School things curriculum management of the delivery of design and technology was organised differently. Being smaller than 'Ruralis' school, curriculum delivery was via departments. At GCSE a decision had been taken to offer one subject that allowed students to access a wide range of materials with which to realise their solutions: textiles, wood, metals, plastics and electronics. The syllabus used was 'Design and Technology: Electronic Products'.

5.3.10 GENERAL OBSERVATIONS ABOUT BOTH SCHOOLS

5.3.11 In terms of student ability, the GCSE percentages of 98% of all children at 'Ruralis' School achieved 1+ GCSEs, and 46% achieved 5+ GCSEs at A*-C creating a very similar exams profile to the 'suburbia' school. Although the samples from both VI forms were smaller, therefore perhaps less reliable, the 'A' level points scores also seemed to show a similar profile. These findings can be verified by archive material relating to the school prospectuses for the academic year 1999-2000.

5.3.12 Both schools were visited in January and May of 1999, on the first occasion to administer the staff and student questionnaire of Action Research Cycle 1. The May visit was to conduct the taped interview with those who completed the questionnaire. Between the cycles none of the sample elected to withdraw from the research.

5.3.13 Each school appeared to enjoy the active support of the parents, in both cases through an active parents association.

5.3.14 GENERAL SCHOOL/DEPARTMENTAL ISSUES ARISING FROM THE ADMINISTRATION OF THE QUESTIONNAIRE ~ ACTION RESEARCH CYCLE 1

5.3.15 When I probed the poorly responded to questions 15 and 16 in the student questionnaire, regarding designing things for local use or putting themselves in others' shoes when designing products in design and technology, the students and staff responded with unanimity.

5.3.16 In piloting the questionnaire I decided, after trials, to put the less structured questions at the end. I now feel, having used the questionnaire 'live' during cycle 1 that it would have been better to intercut the structured with the unstructured questions. When questioned on my visit to both schools during Cycle 2 to conduct the taped interviews, students did indicate they found the length of questionnaire and use of some language a little difficult. As a teacher-researcher I found some difficulty in attempting to get the balance right between making the questionnaire accessible to 'A' level students, finding out the information I needed for my Investigation and also being mindful of satisfying the course regulations.

5.3.17 In question 14 of the Student Questionnaire I asked for lists of projects and material focuses from year 7 through to year 12. From this I discerned a difference in emphasis between the schools, concerning the materials emphasis and GCSE syllabus selections at Key Stage 4. One school focussed upon electronics, the other emphasised the full diversity of subjects from food to product design. During my visit to each school during Cycle 2, by observation and use of taped interview, I was able to verify these differences.

5.4 The Action Research Cycles

5.4.1 There were two Action Research Cycles. For a description of the shape and format of the cycles see section 4.2.5.

5.4.2 The first involving the design, piloting and administration of a ten page questionnaire.

5.4.3 The second cycle involved a follow up taped interview, probing some of the answers given in the questionnaire, for clarity and to try and minimise ambiguity.

5.4.4 As mentioned in section 4.2.5, each cycle involved planning, 'doing', reflecting and further reading.

5.4.5 THE REPORTING OF ACTION RESEARCH CYCLES

5.4.6 ACTION RESEARCH CYCLE 1 ~ QUESTIONNAIRE

5.4.7 QUESTIONNAIRE ~ STRUCTURE OF QUESTIONS

5.4.8 This research instrument came in two versions, one for staff and the other for students. They were both basically the same, with staff being asked details about their career profiles, plus more detail about 'intelligencies' (question 8), and 'philosophies' (question10), within design and technology.

5.4.9 The following are extracts from the rubric of the questionnaires:

STUDENT QUESTIONNAIRE

The questionnaire has a total of 15 questions, organised into 8 sections:

Section 1 - Background information	Questions 1-4
Section 2 - Characteristics of D&T	Questions 5-6
Section 3 - Knowledge & Processes used in D&T	Questions 7-8
Section 4 - Assessment	Question 9
Section 5 - Capability	Questions 10-11
Section 6 - Your journey from Y7 to the VI Form	Question 12
Section 7 - School in general	Question 13
Section 8 - School specific details	Questions 14-16

and

STAFF QUESTIONNAIRE

The questionnaire has a total of 15 questions, organised into 8 sections:

Section 1 - Background information	Questions 1-3
Section 2 - Characteristics of D&T	Questions 4-5
Section 3 - Knowledge & Processes used in D&T	Questions 6-8
Section 4 - Assessment	Question 9-10
Section 5 - Capability	Questions 11-12
Section 6- School in general	Question 13
Section 7 - School specific details	Questions 14-16

5.4.10 GENERAL CHARACTERISTICS, SPECIFIC CHARACTERISTICS AND ISSUES RELATING TO TECHNOLOGICAL CAPABILITY

5.4.11 GENERAL CHARACTERISTICS OF 'TECHNOLOGY'

5.4.12 The heart of the questionnaire lies in the questions on the characteristics of design and technology. The first question considered respondents' views on the 'General Characteristics' of 'Technology':

People appear to have strong views about technology.

Technology to me is:

(please place a cross somewhere on each scale line to represent where your current views tend towards. The further from the centre, the more you agree with the phrase at the left or right hand end)

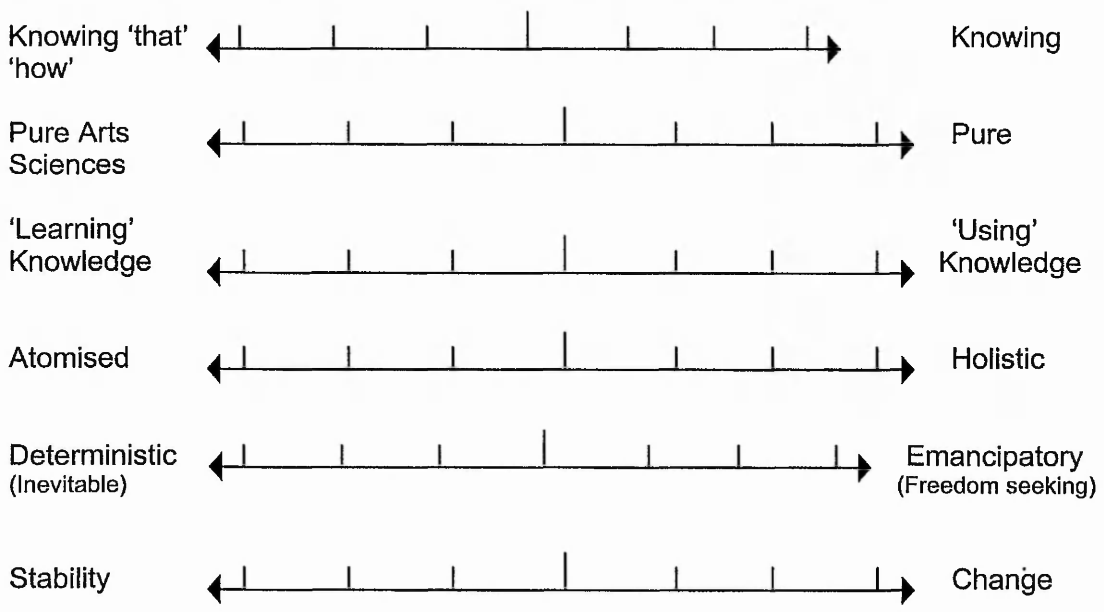


Figure 5.1

5.4.13 The scale I chose to adopt was a numerical one, if respondents

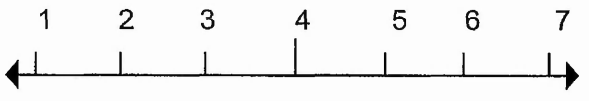


Figure 5.2

placed their cross in between the lines then a decimal equivalent was ascribed. E.g. the mid-point between 5 and 6 would be 5.5, etc..

5.4.14 STUDENT RESPONSES

5.4.15 In this section, for 91% of all respondents, their respective school was the only (secondary) school they had attended. One student in 'Ruralis' School has joined the school at the start of the VI form, having been educated in a large city in the West Midland region. This is referenced in the archive ~ (School R1, Student BC, Tape 1 Side 1, Counter ***).

5.4.16 On each of the general characteristics, the responses were as follows:

	Ruralis	**Suburbia**	**Variance**
'That' vs. 'How'	4.7	4.5	-0.2
Arts vs. Sciences	4.3	4.5	+0.2
'Learn' vs. 'Use' Knowledge	4.5	3.5	-1.0
Atomised vs. Holism	4.2	4.1	+0.1
Deterministic vs. Emancipatory	5.3	4.5	-0.8
Stability vs. Change	4.5	5.5	+1.0

Figure 5.3

In applying themselves to the question, generally the students placed crosses on top of the scale division lines.

5.4.17 A 2D array of responses ~ see 4.4.7, can be located in appendix 4.3.3, the perceptions of each individual student can be traced, and general trends or 'clusters' ~ see 4.5.2, of responses can be discerned more easily.

5.4.18 The general 'Pointers' ~ see 4.5.2, are summarised in bullit points below:

- 100% of all respondents tended toward the belief technology as knowing 'how' to do something, rather than knowing 'that'.

- 22% of students, from both 'Ruralis' and 'Suburbia', thought technology leant more towards 'Arts' than 'Sciences'. 44% of students, again from both schools, felt it was a balance. The remainder of students, from both schools, 34% felt that technology leant towards the sciences.

- In general 'Suburbia' students felt that technology was concerned more with 'learning' than using knowledge. This is in contrast with 'Ruralis' students who felt that it was either a balance between learning and using (67%), or it tended toward 'using' knowledge (33%). A possible explanation for this might be located in the different GCSE courses that the students undertook ~ see 5.3.5 and 5.3.9.

- The greatest degree of unanimity, tending to the centre of the scale ('Ruralis' 4.1 and 'Suburbia' 4.2) occurred in the belief that technology was very much an 'holistic' experience, as opposed to an 'atomised' entity. Only one student felt that it was 'atomised'.

- The predominant view was that respondents saw themselves as operating within an 'emancipatory' paradigm, as opposed to 'deterministic'. 34% of students felt that technology was a balance between freedom seeking and inevitable.

- In the final part most replies indicated that technology was concerned with 'change', as opposed to being a force for stability.

Only one respondent felt it was a force for stability, 34% of students felt it represented neither 'stability' nor 'change', but a balance between the two.

5.4.19 STAFF RESPONSES

5.4.20 In this section it must be acknowledged that whereas the 'Suburbia' School staff had only experience of working in suburban schools, the 'Rural' School staff had taught in urban and suburban settings previously.

5.4.21 On each of the general characteristics, the responses were as follows:

	Ruralis	**Suburbia**	**Variance**
'That' versus 'How'	5.625	4.750	-0.875
Arts versus Sciences	4.000	5.250	+1.250
'Learn' versus 'Use' Knowledge	6.625	5.250	-1.375
Atomised versus Holism	6.000	6.250	+0.250
Deterministic vs. Emancipatory	6.750	5.375	-1.375
Stability versus Change	7.125	6.250	-0.875

Figure 5.4

5.4.22 A 2D array of responses ~ see 4.4.7, can be located in Appendix 5.1, the perceptions of each individual teacher can be traced, and general trends or *'clusters'* ~ see 4.5.3, of responses can be discerned more easily.

5.4.23 The general *'pointers'* ~ see 4.5.2, are summarised in bullit points below:

- All staff tend toward technology as knowing 'how' to do something, rather than knowing 'that'.

- The 'Rural' school teachers thought technology was a balance between Arts and Sciences ~ see 5.3.2. In the 'Suburbia' school, the teachers saw technology as much more concerned with 'Sciences' than 'Arts' ~ see 5.3.6.

- All respondents were firmly of the opinion that technology is much more about 'using' knowledge, as opposed to 'learning' it.

- The greatest degree of unanimity, at an extreme of the scale occurred in the belief that technology was very much an 'holistic' experience, as opposed to an 'atomised' entity.

- Again regarding technology, all respondents saw themselves as operating within an 'emancipatory' paradigm, as opposed to 'deterministic'.

- In the final part there was a high degree of unanimity suggesting that technology was very much concerned with 'change', as opposed to being a force for stability.

5.4.24 OTHER RESPONSE 'CLUSTERS' ~ see 4.5.4.

5.4.25 There were two other comparisons of data combinations that were made.

5.4.26 ALL STUDENTS COMPARED TO ALL STAFF

5.4.27 The first alternative *'cluster'* analysis compared the averaged response of all students, and compared them to the averages of all staff. The results of this comparison are shown below:

Detail	Average All Students	Average All Staff	Variance	Comment
'That' vs. 'How'	4.6	5.187	+0.5875	All tend to 'How' ~ Staff more than Students
'Arts' vs. 'Sciences'	4.4	4.625	+0.2240	All tend towards 'Sciences' ~ Staff slightly more than Students
'Learn vs. 'Use'	4.0	6.000	+2.0000	Students see a balance. Staff tend toward 'Use'
'Atomised' vs. 'Holistic'	4.15	6.125	+1.4750	All tend to 'Holistic' ~ Students slightly more than Staff
'Deterministic' vs. 'Emancipatory'	4.9	6.0625	+1.1625	All tend towards 'Emancipatory' paradigm
'Stability' vs. 'Change'	5.0	6.6875	+1.6875	All significantly tend towards 'Change' ~ Staff more so than Students.
Any General Observations	Balanced to centre	Polarised to right (->)		

Figure 5.5

5.4.28 The two characteristics that seem to show any significant variation are regarding 'learning' knowledge as opposed to 'using' it, and also whether technology is viewed as a 'stabilising' force or as a 'change' agent.

5.4.29 Staff significantly lean towards the view that technology is about 'using' knowledge. Students see it as a balance between 'learning' and 'using' knowledge. As mentioned earlier ~ see bullit point 3 in 5.4.18, differences may well be influenced by the different syllabuses studied at GCSE ~ see 5.3.5 and 5.3.9.

5.4.30 An interesting avenue to explore, but beyond the remit of this current Investigation, is the effect that the birth and subsequent rebirths the National Curriculum has had on teachers' attitudes towards change. In this question all of the staff asked saw technology as being concerned with 'change'. Students also believed this to significantly be the case, but not to the extent that their teachers did.

5.4.31 'RURALIS' SCHOOL COMPARED TO 'SUBURBIA' SCHOOL

~ Students and Staff together ~

5.4.32 The second alternative *'cluster'* analysis compared the averaged response of the members of the 'Suburbia' community (Staff and Students combined), and compared them to the averages of all 'Ruralis' Staff and Students. The results of this comparison are shown below:

Detail	Average All Suburbia	Average All Ruralis	Variance	Comment
'That' vs. 'How'	4.625	5.1625	+0.5375	All tend to 'How' ~ 'Ruralis' more than 'Suburbia'
'Arts' vs. 'Sciences'	4.875	4.1500	-0.7250	All tend towards 'Sciences' ~ 'Suburbia' more than 'Ruralis'
'Learn vs. 'Use'	4.375	5.5625	+1.1875	All tend towards 'Use' ~ 'Ruralis' significantly
'Atomised' vs. 'Holistic'	5.175	5.1000	-0.0750	All slightly tend to 'Holistic' ~ No significant difference
'Deterministic' vs. 'Emancipatory'	4.9375	6.0250	+1.0875	All tend towards 'Emancipatory' paradigm ~ 'Ruralis' more than 'Suburbia'
'Stability' vs. 'Change'	5.875	5.8125	-0.0625	All significantly tend towards 'Change' ~ no significant variation
Any General Observations	Tend to right -(>)	Tend to right -(>)		

Figure 5.6

5.4.33 The two characteristics that seem to show any significant variation are regarding 'learning' knowledge as opposed to 'using' it, and also whether technology is viewed as 'deterministic' as opposed to 'emancipatory'.

5.4.34 'Ruralis' members significantly lean towards the view that technology is about 'using' knowledge. As mentioned earlier ~ see bullit point 3 in 5.4.23, differences in view between schools may well be partly explained by the different syllabuses studied at GCSE ~ see 5.3.5 and 5.3.9.

5.4.35 On a personal note, the most surprising statistic was the one concerning technology operating within an 'emancipatory' or 'deterministic' paradigm. 'Ruralis' members were more inclined towards freedom seeking, than were the 'Suburbia' students. As both had tended towards emancipation I considered it inappropriate to pursue this difference any further, in terms of this particular Investigation. It is an area of intrigue that I would like to proceed with at another time.

5.4.36 SPECIFIC CHARACTERISTICS OF DESIGN & TECHNOLOGY

5.4.37 Having carried out a wide ranging and personally enlightening literature review, I synthesised down a set of 41 possible ' specific characteristics' ~ see 5.4.43, that respondents were asked to express a view on, from strongly agree to strongly disagree, on a 'Likert Scale' ~ see Robson (Op. Cit., pp.256-260). An example of the type of question is shown below:

	Strongly Agree	Agree	No Strong View	Disagree	Strongly Disagree
Technology Uses Scientific Knowledge	[ ]	[ ]	[ ]	[ ]	[ ]

To enable me to read as widely as possible on the subject I included books, journals and Internet articles from a number of countries outside the United Kingdom, including: Australia, France, Germany, Japan and the United States of America. From the latter case I made extensive use of the 'Technology for All Americans' initiative ~ see 2.2.50.

5.4.38 As mentioned earlier ~ see section 4.5.3, I arranged the responses to some questions in different combinations or 'clusters' of data. I checked for agreement on 'Specific Characteristics of Design and Technology' within different pairings of groups. These included:

- 'Ruralis' Students and 'Suburbia' Students
- 'Ruralis' Teachers and 'Suburbia' Teachers
- 'Ruralis' Students and 'Ruralis' Teachers
- 'Suburbia' Students and 'Suburbia' Teachers

5.4.39 DIFFERENT COMBINATIONS OF 'CLUSTERS' OF QUESTIONNAIRE RESPONDENTS

5.4.40 As indicated above I carried out a series of four combinations of findings, combined them together to see if there were agreements about specific characteristics. These I then combined with other groupings, as illustrated in the diagram below:

Diagram to show 'Second Order Clustering'

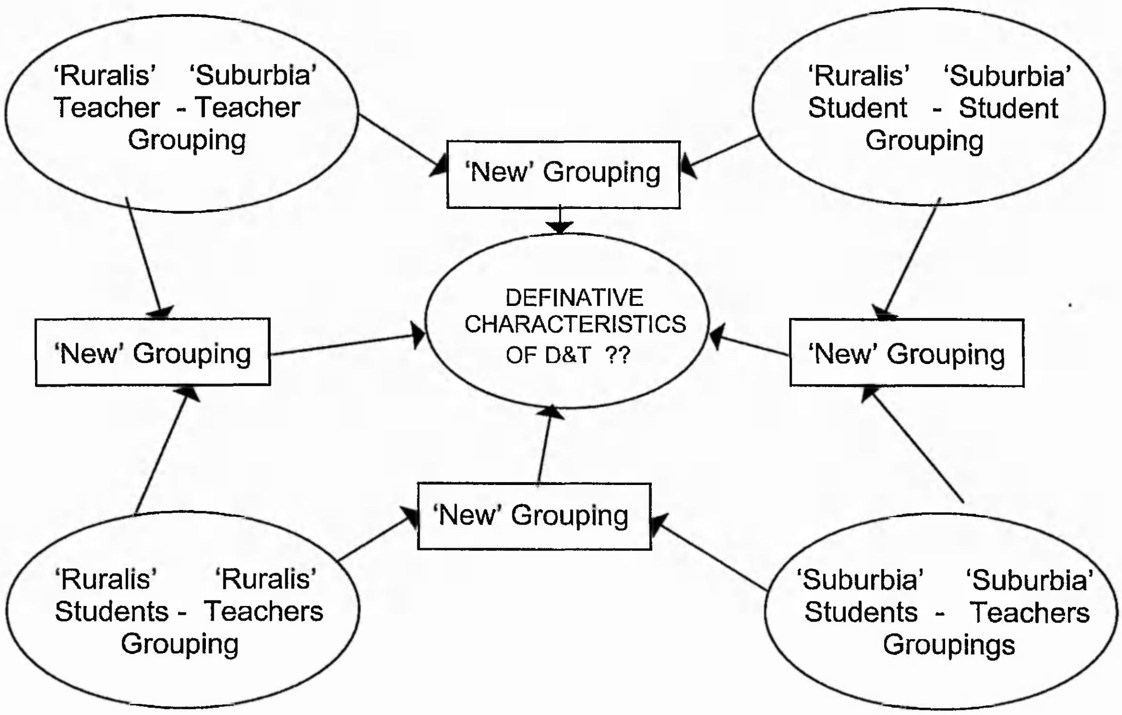


Figure 5.7

5.4.41 The evidence of this process can be located in Appendix 5.2, under the title of 'Staff and Student Analysis'. The actual questionnaires are not located in the appendices, but are in the archive to protect anonymity, they are available for verification.

5.4.42 LIST OF AGREED SPECIFIC CHARACTERISTICS OF DESIGN AND TECHNOLOGY

5.4.43 The following is a list of 'Specific Characteristics of Design and Technology', having 'evolved' into the centre of the model illustrated in Figure 5.1:

DESIGN AND TECHNOLOGY:

- uses scientific knowledge
- promotes the transfer of knowledge
- has some knowledge that cannot be written down
- uses mathematical concepts
- solves problems
- balances thinking with doing
- encourages deep and wide thinking
- encourages reflection on what is important
- encourages us to co-operate
- promotes collaboration
- has a positive impact upon society
- strives for integrity
- seeks to 'guard' the earth's resources
- encourages the production of quality products
- encourages students to be self-motivated
- provides skills which are transferable
- promotes autonomy
- provides skills that may be useful in employment ('jobs')
- helps to develop 'troubleshooting' skills
- promotes a positive attitude towards the notion of 'change'
- teaches us to summarise effectively
- helps us to make informed comparisons

There were many other characteristics that 'most' groups agreed with, but this list of 22 were the ones that secured 100% agreement.

5.4.44 These findings are as a result of quite significant 'data groupings' and comparisons, in an attempt to pursue 'plausibility' as suggested by Miles and Huberman (Op. Cit., pp. 246). As commented extensively throughout this report, the lack of claim to being generalizable acknowledges the fact that the work is developmental and clearly would need to be subjected to further Action Research Cycles and a much wider sample of students.

5.4.45 OTHER QUESTIONS RELATING TO DESIGN & TECHNOLOGY EDUCATION

5.4.46 The questionnaire has proven to be an effective research instrument, but with the benefit of hindsight I would have restricted the number of questions to less than five, as the subject of this analysis has reflected at length on only two of the questions from the questionnaire. Although I asked questions on: Technological Knowledge, Technological Processes, 'Intelligencies' relevant to Design and Technology, Technological Literacy, and Technological Capability, there is no opportunity to report on the findings in this work. They must remain as an avenue for me to explore later.

5.4.47 Although unable to use the above work in this report, it did increase my background knowledge and has enabled me to analyse those aspects discussed here and reflect from a 'richer' base as a result. The responses to the undeveloped questions are available in Appendix 5.3.

5.4.48 CYCLE 2 ~ TAPED INTERVIEWS ~ PROBING SPECIFIC ISSUES RELATING TO THE QUESTIONNAIRE ~ CHARACTERISTICS OF TECHNOLOGICAL CAPABILITY, DESIGN AND TECHNOLOGY EDUCATION, AND CONTEXTUAL EFFECTS

5.4.49 One important reason for conducting a taped interview with questionnaire respondents was to provide an opportunity to triangulate the data from Action Research Cycle 1, by feeding back the results, and requesting any comments. To help with this I made the questionnaires available to the respective respondent, and invited comment as to accuracy of my feedback, or otherwise.

Triangulation is a concept I have dealt with in sections 4.3.15 and 4.4.10.

5.4.50 As mentioned earlier, the questionnaire was quite lengthy, and responses were the shortest or most incomplete towards the end of the instrument. The taped interviews were an opportunity to probe the seemingly poor responses.

5.4.51 In section 1.4.17 I refer to a conversation with Professor Morwenna Griffith, in which the research process was described as 'lumpy and messy'. With the constant reflection, constant mistakes and continuous reading, punctuated by the demands a full time teaching post, so it proved to be the case. Writing up this section of the Investigation has been the most taxing, despite the care I endeavoured to take with filing, memo writing and continually sorting data, as recommended by Miles and Huberman (Op. Cit., pp.10-12)

5.4.52 ACTION RESEARCH CYCLE 2 ~ OBSERVATIONS

5.4.53 The opportunity to visit the schools and see and discuss student's work was an unexpected, but valuable outcome of visiting the schools to conduct the taped interviews.

5.4.54 I made use of my journals, by way of referring to the reflective notes from Cycle 1 that I made, and was able to clarify the seemingly poor response to the latter questions on my questionnaire used during Cycle 1. I was also able to explore and clarify other responses, such as the seemingly ambiguous response to the questions concerning values ~ see 5.3.15 and Appendix 5.1.

5.4.55 Until part way through Cycle 2 I had not grasped the value or significance of reading between Cycle 1 and 2, and even after that. Although difficult to delineate, as reading has been going on since and during the Investigation, the constant reflection that continuous reading encourages is perceived by myself as being of significant benefit. It has, at times, kept me both on and off task both appropriately and inappropriately. This adds to the feeling of the Action Research Cycles as being 'messy'.

5.4.56 ADDITIONAL EVIDENCE OF D&T ACTIVITIES WITHIN THE PARTICIPATING SCHOOLS

5.4.57 In addition to discussing and viewing the student's actual project work during my Cycle 2 visits to participating schools, I was extremely fortunate in being furnished with copies of schemes of work, departmental handbooks and school brochures, by colleagues. As mentioned in section 5.2.8, these do not appear in the appendices, but are available for verification. They have been a valuable source for reflection and as a tool for confirmation/verification.

5.4.58 DISCUSSION OF 'DIFFERENCES' FOUND

5.4.59 Regarding the notion of 'Beliefs/Values' I included reference to it twice within the Cycle 1 questionnaire, to check for consistency of answer. Having got an ambiguous response, mainly favourable in Question 12f, largely negative in staff question 5w (question 6w for students):

Question 6w	Beliefs and values are important when doing D&T
Question 12f	Make value judgements regarding actions whilst solving problems

I explored the issue during the taped interviews. Although I had suspected it, both staff and students confirmed that the word 'values' was confusing to them, and the responses given were not reliable. It also explained the lack of responses to question 12f.

5.4.60 In sections 5.3.5 and 5.3.9, I drew attention to the different curriculum delivery organisations of the two schools, one being a Design & Technology Department, the other being a Design Faculty. I also noticed that one school offered only one syllabus at GCSE (Electronic Products), whereas the other offered three (Resistant Materials, Food and Textiles). By a combination of observing when in the participating schools, reading the schemes of work provided, and talking to the VI form students, I was able to confirm why students from one school leant toward electronics, the other oriented toward design.

5.4.61 The choice of specialist material exposed to at GCSE does seem to bear a relationship with the types of activity the students appear to be comfortable with at 'A' level. Again, to explore this would be beyond the remit of this Investigation, but would form the basis of interesting research.

5.5 Exploration of 'New' Personal Understandings

5.5.1 DEPTH OF UNDERSTANDING OF TECHNOLOGICAL CAPABILITY

5.5.2 When looked through in detail, the research findings, particularly from the questionnaire, and to a lesser extent when listening to the taped interviews, the evidence collected has enhanced my understanding and perception of technological capability, compared to the start of this Investigation. To achieve progress, I felt it necessary to carry out a wide literature review, and apply knowledge gained to the development of a research instrument ('the' questionnaire). This praxis I have come to regard as being a strength of the Investigation, in terms of how it has helped me to broaden out my perception of technological capability.

5.5.3 FROM THE LITERATURE REVIEW

5.5.4 As outlined above, and in section 6.1 of the next chapter, my own personal views and stance toward technological capability have changed significantly, this being evident when comparing the starting definition I quoted in 2.1.4, with my emergent definition in 6.4.3. Although not solely as a result of the literature review, it had a major influence upon it.

5.5.5 FROM THE RESEARCH DESIGN

5.5.6 As illustrated in section 5.4.6, the process of designing the questionnaire, grouping & regrouping information, helped me to discern links between and across all of the categories of questions I included. This has been important to me, often when reading articles on design and technological education I find myself consciously reflecting upon the bearing they might have on technological capability.

5.5.7 Also the act of thinking and reflecting on different questions from the reshaping process has set up a type of iterative process, which may or may not have been present in me before. The Investigation has either been introduced as a result of this study, or I have been made conscious of its presence. In section 6.4.5 and 6.4.6, I refer to this in two categories of my new definition of technological capability, technology as volition, and technology as reflective thinking.

5.5.8 FROM THE PROCESS OF CONDUCTING THE RESEARCH

5.5.9 Discussing design and technological issues with children and students is never a chore for me, I find the honesty and frankness refreshing. As a parent of children who are 6 years and 4 years 6 months respectively (In May 1999), constant questioning is a joy to behold and respond to. My visits to the participating schools I undertook with relish, and I feel that, by virtue of the fact that nobody chose to withdraw from Cycle 2 of the research, having completed Cycle 1 would tentatively suggest that we might all have gained something from undertaking the research together.

5.5.10 I built up a good working relationship with the staff whom participated, and we have subsequently shared materials that were unconnected with this Investigation. This I judge to be a valuable 'spin-off' from participative, or hands-on research.

5.5.11 Being able to exercise my own reflective practice as a result of researching in other Design and Technology departments has seemed to add a refreshingly new dimension to my functioning as a head of department. Seeing, in context, both a different approach to the design and technology curriculum, and also witnessing 'snapshots' of different styles of management, have caused me to be more aware of both how I interact with members of my own department, and also how we might see our own existing curriculum from a different perspective. As a head of department, I am still a technologist, who perhaps should be striving to be more capable.

5.5.12 WIDER PRACTICE OF DESIGN & TECHNOLOGICAL EDUCATION

5.5.13 Of all of the outcomes of my research, the most striking was the common understanding that appears to exist as to the nature of the subject of Design and Technology. This clarity is mirrored in the findings of my research when considering both the *general* and *specific* characteristics of design and technology. I was both pleased and surprised to find the strength of agreement on general characteristics, as discussed in section 5.4.43.

5.5.14 CONTEXTS

5.5.15 Although a little uneasy in contemplating the thought, having looked at the importance of context specificity in detail in Chapter 2, I began to feel that my original research question about whether the acquisition of technological capability was uniform in rural and urban contexts, could be answered before the analysis and conclusions were undertaken. In one sense the question now appears to me to be quite naïve, but the experiences that I have been exposed to, and the knowledge I have gained has personally had a significant impact upon my practice, both as subject teacher and as middle manager.

5.5.16 Regarding the original question, I did not find 'rural' students making anti-tilting devices for tractors, nor did I find 'suburban' students designing concrete sculptures for use in the play area at the foot of a block of high-rise flats. What I did find was broad agreement on both the nature and specific characteristics of what constitutes design and technological activity. Given that each student is a unique individual, and each context is unique, I feel that my quest to find if the acquisition of technological capability was 'uniform' was, with a considerable degree of hindsight, somewhat misguided.

5.5.17 In section 6.7 of the next chapter I argue that my original 'main' research question has been answered, by virtue of the fact that I ought to have asked a different question, one that I feel to have the knowledge to answer as a result of this Research Investigation. However I remain happy to answer the research question set, and in doing so fleshing out the thoughts I now have regarding what I should have asked, with the benefit of hindsight.

5.6 The Process and Products of Research

5.6.1 Using metaphor, although this Research Investigation is only part of the doctoral 'journey', it has proven to be a significant 'port of call' on a long excursion. I have marvelled at the 'wonders of the world' which I have been exposed to, and I feel to have been changed forever by the experiences I have encountered *'en route'*.

5.7 Conclusions

5.7.1 Although it was not an aim of this Investigation to make a 'Claim to Knowledge', my idea of unparalleled combinations of command verbs to define subject uniqueness ~ see section 3.1.6, has captivated my imagination and I hope to pursue this line of thought further in the future. This, amongst other events, has made my research feel 'proper' and 'legitimate' to myself, something I often seem to struggle with.

5.7.2 I now feel strongly that my research instrument (questionnaire) deployed in Action Research Cycle 1, simply contained too many questions. This analysis ostensibly made use of only two questions: general characteristics of 'technology', and specific characteristics of design and technology as a school subject.

5.8 Reflections

5.8.1 With the emphasis I have placed on *'context'* in Chapter 2 of this work, I have acknowledged the fact that it clearly affects work, technological work being no exception ~ each context is unique. I have during the course of this study accrued no evidence that rural or suburban contexts offer 'exclusive experiences' *vis-a-vis* technological capability. In recognition of this I now acknowledge that the presence of the word 'uniformity' in my research question now appears *gauche* to myself. This should not be taken as an apology, if I had not undertaken the journey, I might not have had the evidence or confidence to make this assertion.

5.8.2 The findings of the data analysis along with its interaction of the other chapters and aspects of the taught course, I assert, demonstrate that I have grown as both a 'teacher-educator' and 'reflective practitioner' ~ see 5.5.4.

5.8.3 I have been genuinely astounded at just how much data (and associated work) can be generated by two seemingly simple questions on a questionnaire.

5.8.4 This has led me to discern exactly how important it is to keep the focus of research very narrow. It has been a genuinely humbling experience to realise just how little I do know.

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

CHAPTER 6

CONCLUSION

"THE WIDER [EDUCATION] DEBATE IS AS MUCH ABOUT HOW SCHOOLS AND PROFESSIONALS RESPOND TO THE DIFFERENTIATED NEEDS OF THE COMMUNITIES THEY SERVE AS IT IS ABOUT THE CENTRE HOLDING CIVIL SOCIETY IN THRALL TO A MONOLITHIC VISION"

STEPHEN BALL 1994

1999 KEITH ATKINSON

6.0 Conclusive Remarks and Future Directions

6.0.1 The conclusive remarks result from the analysis carried out in Chapter 4, and from the review of literature evident from Chapters 2 and 3. As the taught elements have run in parallel to this Research Investigation over a period of 18 months, their influence has implicitly impacted upon the work also.

6.0.2 The Aims of this Chapter are:

- To acknowledge the interpretation placed upon conclusive remarks made as being from my own perspective.
- To formally recognise that my perspective of the work may not be the only one discernible.
- To recognise the constraints and subsequent effects placed on the work by the structure of the taught doctorate course in acknowledging the legitimacy of developmental research.
- To place the Investigation in context by recognising it as the culmination of a three year doctoral journey.
- To make explicit the links between the summative Coherence and Integration Report III ~ see Appendix 6.1, and the conclusive remarks of this Investigation.
- To reflect upon the resulting observations and Interpretations that I have discerned as a result of the interplay between the developmental 'Research Investigation' and the taught modules of the Doctorate in Education of The Nottingham Trent University:

- <u>Research Question 1~ Conclusive Remarks</u>

  Technological Capability in 'rural' and 'suburban' contexts

- <u>Research Question 2~ Conclusive Remarks</u>

  Student and teacher perceptions of Technological Capability

- <u>Research Question 3~ Conclusive Remarks</u>

  Technological Capability and Teaching, Learning and Thinking

- <u>Research Question 4~ Conclusive Remarks</u>

  Myself, Change and the 'Doctoral Journey'

- <u>Research Question 5~ Conclusive Remarks</u>

  The Compression of Time and Research Methodology

- To reflect upon my emergent conceptualisation of subject uniqueness as unparalleled combination of command verbs.

- To suggest how the tentative conclusive remarks might be utilised for future research and practice.

6.1 My Own Personal Views/Stance

6.1.1 Nearing the end of the course, there are two quotes that I have encountered that reminded me of the feeling of being in a type of catatonic stupor, following the maelstrom caused in the aftermath of the introduction of the National Curriculum, from the late 1980s to the mid-late 1990s:

> "...school people have been badly disillusioned by the galloping hoof beats of those itinerant education peddlers who ride in and out again exhorting the latest elixir."
> Mulford (1994, p.21)
>
> and
>
> "...if teachers and schools continued to lower their heads and pull their classroom or management carts, it should come as no surprise if they ended up at destinations they did not select."
> Bottery & Wright (1997, p.11)

The doctoral journey has taught me to constantly question, reflect upon what is being presented to me, and to reflect on matters as a natural part of my practice as a teacher.

6.1.2 At the end of each year of the 'taught' modules, I was required to write a report that drew together the work of that year. There are two books that I read as a teenager that evoked powerful images in my mind, that I had long since forgotten about. The first was Aldous Huxley's (1932) book, 'Brave New World', portraying a polarised science fiction world of 'Epsilon Minus Morons' and 'Alpha Plus Intellectuals'.

6.1.3 I reflected upon the first year of the doctoral work, realising that I felt as though I had unwittingly slipped into the role of an 'Epsilon Minus Moron' by often taking whatever the NCC/SCAA/QCA pushed out into schools, and envisioning how it could be pragmatically be implemented, without consideration of the intrinsic validity of the documentation itself.

6.1.4 The second book was by C. P. Snow (1969) entitled 'The Sleep of Reason'. I remember the gist of the book being that if one allows one's reason to be suppressed, we are all capable of profoundly wicked behaviour. During Year 2 of the doctoral course I began to realise that in the intervening thirteen years since first qualifying as a teacher I felt as if I had slowly let my 'reason' drift into sleep mode.

6.1.5 The work I did for my Master of Arts degree ~ see Atkinson (Op. Cit.), on 'Values' had unwittingly begun to reawaken my desire to question, probe and argue. My ability to enjoy a 'good argument' was a facet of my personality that had receded with the passage of time since 1983. I had put this down to maturity, I now see that constant questioning to be not only good, but important in the pursuit of a personally creative existence. I genuinely believe that the Doctorate in Education at The Nottingham Trent University has had a profound effect upon me, in this respect.

6.1.6 This Research Investigation, has been developed against the backdrop of my feeling re-invigorated, the work has also deepened my enthusiasm for my chosen subject of Technology (Design and Technology).

6.1.7 Chapter 2 highlighted contextual influences through which this work has developed, and as a result of my work at doctoral level, my main research question I now judge to have been somewhat naïve or 'misguided' in hindsight ~ see 5.5.16. The question I have still left in its original form, but did not prove to be at the epi-centre of this Investigation, as I originally intended. I must stress that I don't view this work as inferior, faulted or worthless, merely it emphasises the point that often the process is as valuable as the product, something that is central to my 'values' led philosophy of design and technology education.

6.2 Overall Aims of the Work

6.2.1 As outlined in section 1.3 of Chapter 1, the overarching *rationale* of the work was to question whether or not the acquisition of technological capability was affected by context. The research question highlighted 'rural' and 'urban' contexts, for research purposes, but it became evident during the course of the Investigation that the focus of my work shifted to become centred on the general and specific characteristics of 'Technological Capability' and the teaching of 'Design and Technology'.

6.2.2 Committed to following the work through in looking at a 'Rural' school and a 'Suburban' school, this added a valuable dimension to the work, but my perception of the notions of 'context specificity' and 'generalizability' had been brought sharply into focus by the interplay between: the 'taught modules', my Coherence and Integration Reports 1, 2 and 3, my personal reading, and this Research Investigation. Chapters 2 and 3 of this report, along with my Coherence and Integration Report 3 ~ see Appendix 6.1, evidence the importance with which I now view the notion of context specificity, both generally and as it relates to this particular study.

6.2.3 Being the first piece of 'genuine educational research' that I had immersed myself fully in, not knowing where my analysis and conclusive remarks would eventually take me, in terms of the research question, the work I did on postmodernism during the course made this a much less intimidating thought than it perhaps would have done prior to engaging with this work.

6.2.4 I claim legitimacy for the work in acknowledging that its main purpose was to improve my practice as a teacher-researcher. Taking all of the assignments I have produced, the vigour with which I have participated in the course, and the breadth of reading undertaken, coupled with being proactive in gathering data for this Research Investigation, I assert that this is demonstrably the case.

6.2.5 In section 1.6.3 of the Introduction, I conclude by expressing hope that this Investigation might result in me leading my department in a more thought provoking and thoughtful manner. Whilst I cannot comment on whether or not this has happened, my team have shared some of the trials and tribulations of the journey with me, and have been influential in mulling over many of the concepts and topics I have encountered during the development of the Research Investigation.

6.3 Exploration of the Resulting Observations and Research Questions

6.3.1 In the first draft of the project, I developed six questions associated with the study, that I wished to explore. In a subsequent redraft, to re-focus the work and slim down Chapter 2 significantly, I decided to remove one question relating to the 'atomisation of assessment'. This still remains an area of significant interest to me, but is now judged to be beyond the parameters of this Investigation.

6.3.2 The other questions survived intact, and an evaluative discussion of each is the focus of the next section of the Conclusion.

6.4 *Research Question 2* ~ Student and Teacher Perceptions of Technological Capability

6.4.1 Instrumental in shaping both the questionnaire I designed for use in Action Research cycle 1, and my own understanding of 'Technological Capability', was the 'Literature Review' I undertook in Chapter 2. Of poignancy to me personally were section 3.1 ~ 'Text and Taxonomies', section 3.2 ~ 'Epistemology of Technology', and section 3.3 ~ 'International Perspectives on Technology Education', as they gave me the confidence to debate and reflect with my supervisor, colleagues in school, other professionals I consulted, and perhaps most importantly, both the students I teach and the staff and students in both of my sample schools.

6.4.2 The discussions I engaged in with the above generated discussion and, coupled with the data from the questionnaires, and subsequent clarification from data triangulation during the taped interviews, focused attention down on defining what exactly 'Technological Capability' meant. As a direct outcome from this project I have a much clearer personal understanding about:

- Providing a '*Working Definition'* of Technological Capability
- Defining Technological Capability in terms of '*General Characteristics'*
- Listing what Specific Characteristics help to define the essence of Design and Technology Education.

6.4.3 A *WORKING DEFINITION* OF TECHNOLOGICAL CAPABILITY

6.4.4 As a culmination of the action research done in schools, and the synthesis of reading from the literature review, I suggest that technological capability has the following six dimensions:

6.4.5 **Technology as Reflection** ~ see section 3.8.

There being two types of reflection:

Historic ~ What has happened in the recent past?
Personal ~ How does this make sense to me?

6.4.6 **Technology as Volition** ~ see section 3.9.

Collaborative, fluent, a mediating experience, conscious willing, experiential pedagogical philosophy, holistic, and interactive.

6.4.7 **Technology as Humanism** ~ see section 3.10

Anthropological, historic, sociological, philosophical ~ sustainable humanity. Analysis of humankind in the material world.

6.4.8 **Technology as Process** ~ see section 3.11

Endless ~ reflective (Schön), modelling, clarifying goals and problem-complexity.

6.4.9 **Technology as Academic Discipline** ~ see section 3.12

Breadth and depth, a body of knowledge. Four areas ~ technology, education, ethics and resources.

6.4.10 **Technology as Outcome** ~ see section 3.13

The values, priorities and needs of cultures that produce artefacts.

6.4.11 **Technology as Vocation/Economics** ~ see section 3.14

Straddles the academic/vocational divide ~ duality of purpose.

6.4.12 In May 1999 I gave a doctoral presentation on my Research Investigation, as 'work in progress'. I have subsequently used this definition to provoke discussion amongst colleagues, and feel comfortable 'defending' my definition in an 'academic sense'. Slide 10 from my doctoral seminar is shown below:

Defining Technological Capability

In a post modern world, capability, as it relates to education (D&T), is, in varying degrees, at various times:

* **Reflective ~ Historically and Personally**
* **Volitional**
* **Humanist**
* **a Process**
* **an Academic Discipline**
* **an Outcome**
* **Economic / Vocational**

Keith Atkinson May 1999 Slide 10

Figure 6.1

For evaluative comments from the audience ~ see Appendix 6.2

6.4.13 GENERAL CHARACTERISTICS OF DESIGN AND TECHNOLOGY

6.4.14 A synoptic view of section 5.4.10, would reveal the following as best describing the 'General Characteristics' of Design and Technology:

- It is more about knowing 'how' than knowing 'that'.
- It is concerned with both 'arts' and 'sciences', marginally inclined to 'sciences'.
- It is slightly less about 'learning' knowledge than 'using' knowledge.
- D&T is 'holistic' rather than 'atomised.
- It tends to be freedom seeking (emancipatory) rather than 'inevitable' (deterministic).
- D&T is strongly associated with 'change' rather than 'stability'.

6.4.15 SPECIFIC CHARACTERISTICS OF DESIGN AND TECHNOLOGY

6.4.16 In Chapter 5 ~ section 5.4.36, I provided a synthesis of several clusterings of data, which showed a list of 'Specific Characteristics' that my research sample assessed as being representative of design and technology. This list is shown below:

DESIGN AND TECHNOLOGY:

- uses scientific knowledge
- promotes the transfer of knowledge
- has some knowledge that cannot be written down
- uses mathematical concepts
- solves problems
- balances thinking with doing
- encourages deep and wide thinking
- encourages reflection on what is important
- encourages us to co-operate
- promotes collaboration
- has a positive impact upon society (N.B. No general agreement on the negative impact)
- strives for integrity
- seeks to 'guard' the earth's resources
- encourages the production of quality products
- encourages students to be self-motivated
- provides skills which are transferable
- promotes autonomy
- provides skills that may be useful in employment ('jobs')
- helps to develop 'troubleshooting' skills
- promotes a positive attitude towards the notion of 'change'
- teaches us to summarise effectively
- helps us to make informed comparisons

6.4.17 As with the 'general characteristics' ~ see 6.4.14, I have subsequently used this as a basis for discussion with colleagues, and initial feedback has been favourable.

6.4.18 Defining technological capability, and attempting to capture and clarify the essence of design and technological activity has captivated my imagination, and generated a lot of renewed vigour for my subject. I feel that clarifying ontological and epistemological issues surrounding technological capability to have been of significant benefit to myself as teacher-researcher.

6.5 *Research Question 3* ~ The Relationship Between Technological Capability and Teaching, Learning and Thinking.

6.5.1 This question was prompted by both the work covered in the 'taught modules' of the doctorate, particularly the 'Ways of Seeing', and a personal feeling that one facet of the uniqueness that design and technology potentially brings to the enhancement of the whole child is the product of iteration between designing and making.

6.5.2 I felt it important, and subsequently beneficial for this particular Investigation to engage with issues of teaching, learning and thinking ~ see section 2.3. The work of Bruner, Kolb and others in expressing learning as a cyclical process was brought back to my attention when reading Zuber-Skerritt's (Op. Cit., p.13) book on Action Research Cycles.

6.5.3 Work covering meta-cognition from the 'taught modules' also informed my thinking and building upon this notion by linking in the work of John Stephenson and the 'Higher Education For Capability' movement on 'Learner-Managed Learning' ~ see 2.3.50 – 2.3.54, helped me to view capability from a fresh perspective.

6.5.4 The 'lumpy and messy' research process, as mentioned earlier ~ see 1.4.17 and 5.4.51, appeared to me to bear a resemblance to the dynamic that iteration implies. Such a thought would make for the development of capability as an interactive, erratic and potentially messy process, instead of being something that has 'uniform' properties, as my original research question implied.

6.5.5 Whilst the work I did, in relation to this study, captivated my imagination, I felt that the pressure on both time and Investigation length (in words) precluded me from developing further my thoughts and notions of models relating to teaching, learning and thinking, in relation to the acquisition of technological capability. This, like a number of other dimensions of this Investigation would have to be shelved for potential exploration in the future. This is a notion that feels personally uncomfortable, but one that I have had to get used to; my nature is that of wanting to know.

6.6 ***Research Question 6*** **~ Time Compression and Research Methodology** and ***Research Question 5*** **~ Myself, Change and the Doctoral Journey**

6.6.1 Having made reference to the constraints that the doctoral deadlines and course structure have placed upon this Investigation, not by way of complaint, merely out of frustration, I wish, again with the benefit of hindsight, that I had had the confidence to have tackled a full Ph.D.. The frustration I have suffered through not being able to explore all topics I wished to in the depth I feel they require has been very constraining.

6.6.2 One of the purposes of originally enrolling onto the Ed.D. course was to challenge myself to see if I was capable of working at doctoral level. Now I know I can, and have been told I am, I do appear to be totally satisfied with my 'developmental' work, which has no 'claim to knowledge'. I hope that work I (hopefully) undertake in the future will hold out the potential to satiate my academic desire.

6.6.3 The Investigation report is well punctuated with examples of how the doctoral journey has impacted upon my professional practice, and also upon myself as an individual. I hope I have been able to convey in writing the eagerness I have displayed in trying to ensure that my work passes the exam board with confidence. I feel it is a fitting testament to the enthusiasm and momentum I have built up for the course, and the benefits that I feel it has bestowed upon me, as indicated within the chapters.

6.6.4 The explicit work covered on 'change' gave me confidence to be able to explore and initiate some quite innovative changes within my role as a middle manager in a comprehensive school. I have flattened out my management style, delegated more tasks, and work hard at binding my team together, by having common aims and a values-led curriculum that is shared by all team members. I also work especially hard at trying to understand those with whom I disagree. This is a tacit benefit of studying at this level.

6.7 *Research Question 1* ~ Technological Capability in Different Contexts

6.7.1 There are two answers to my original research question:

Is the acquisition of technological capability uniform in rural and suburban contexts?

6.7.2 The first answer is simply no. As mentioned in section 5.5.16, the importance that I have place on context specificity make me now view the notion of conceptualising any type of human development as uniform as rather naïve.

6.7.3 As with 'lumpy and messy' research, as it appears in practice, I have drawn a strong parallel between this and how I observe children when they are designing and making products as part of their GCSE work. In the same way that there are many neatly laid out books showing research methods neatly and tidily, the reality on the ground is somewhat different, so it is with children who undertake GCSE coursework. The design process looks so straightforward, yet sixteen years of practice confirms the reality as far less so.

6.7.4 The understanding I have of the delivery of design and technology at 'A' level as a result of my action research has been beneficial to me, as I have always found it to be the case when colleagues get together to share good practice.

6.7.5 The greater clarity with which I feel I now understand 'Technological Capability', has also been of benefit to me, especially as I feel that it is as a result of a 'genuine research project'. I have a sense of pride from my altered perception of technological capability coming partly from the thoughts and ideas of VI form students, and partly from undertaking a literature review of in excess of 300 books, journals and articles.

6.7.6 I found no discernible difference from the design and technological experiences that 'rural' students had, compared with those of 'suburban' students. What I did find instead, as can be verified in my data set, was broad agreement about the essential nature of the subject of design and technology and what it is doing on the curriculum. For a full account please refer to Chapter 5, and also a copy of the data reduction matrices in Appendix 4.3 ~ see also 4.3.4, 4.3.5 and 4.3.6.

6.7.7 The second answer to the main research question is to respond by saying it is the wrong question to have asked from the outset. However the conundrum here is that until I had made considerable progress along the research journey, I did not perceive it to have been the wrong question. I use the word 'wrong' in the sense that I could have phrased the question differently, to reflect where I did place the greatest emphasis of the study, e.g. in fully exploring 'technological capability' and how it affects design and technology education.

6.8 Subject Uniqueness as unparalleled combination of Command Verbs

6.8.1 As mentioned in 3.1.6, an idea sprung into my mind when thinking about the use of text and taxonomies to explore the notion of capability.

6.8.2 The idea is based around the notion that subjects share the use of 'command verbs' with other school subjects, e.g. all subjects use them. My hypothesis is that a subject's uniqueness may be governed by an unparalleled combination of command verbs. For instance Art and (D&T) both use 'drawing' to communicate ideas. Whereas D&T invariably then requires students 'to make' something that has 'to work' for example, a 3D artefact, Art does not necessarily call upon the same command verb. By the same token many of the command verbs that Art utilise may well not exist in the same combination for D&T.

6.8.3 Although in its infancy, it is an idea that has captivated my imagination. I am keen to explore it in the future. Prior to starting out on the doctoral journey, I would have considered such philosophical thoughts to be beyond my capabilities.

6.9 Utilising Conclusive Observations for Future Research and Practice

6.9.1 As indicated in sections 6.6.1 and 6.6.2, my frustration over the constraints that the course structure has placed upon my Investigation has caused me to consider at some length how it could be expanded upon. There are two ways I have thought about. One is via a more comprehensive *'Cross-sectional'* Study, the other is by a *'Longitudinal'* Study.

6.9.2 CROSS SECTIONAL STUDY

6.9.3 More schools would need to be involved, to broaden the student sample, and hence strive for more significance, both in terms of statistics and also subsequently for legitimacy. This would move the work from the realms of 'development' and potentially into the domain of 'claim to knowledge'.

6.9.4 Three or more Action Research Cycles would be beneficial, with some type of classroom observation or evaluative monitoring. Perhaps even developing my notion of 'command verbs' ~ see section 6.8.

6.9.5 LONGITUDINAL STUDY

6.9.6 Probably within my own school, due to the protracted timescale. Or my own school plus another for control purposes. Again I would probably use Action Research as my methodology. I would also possibly aim to incorporate such a study into schemes of work, for reasons of evaluation and continuity/commitment.

6.10 Conclusions & Reflections

6.10.1 By way of conclusion and reflective thought, I wish to offer up another slide from my doctoral presentation. It gives eight personally poignant reflections, as a metaphorical *'signpost'* at *'Land's End'*.

The Nottingham Trent University

Doctorate in Education

Technological Capability within Rural and Suburban Contexts

Conclusive Remarks

* Unsure at the start
* Fully engaged with the course
* Clearer about myself as educator ~ reflective
* Clearer about ontological and epistemological facets of technology and technology education
* Frustrated that research investigation raised more questions/avenues than I could answer/explore
* Made me anxious/restless about exactly how little I know
* Affected my thought processes ~ ordering arguments in my head and how I articulate myself on paper
* My own answer to what a doctorate is: Taking nothing for granted, constant questioning and reflection

Keith Atkinson May 1999

SEMINAR PRESENTATION ~ 12

Figure 6.2

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

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&
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"BOOKS THAT HAVE HAD THE DEEPEST IMPACT ON MY OWN VIEWS OF EDUCATION HAVE NOT BEEN RESEARCH REPORTS. IMAGINATIVE LITERATURE HAS BEEN MUCH MORE IMPORTANT. PLATO, ROUSSEAU, DEWEY AND STENHOUSE ARE MY FOUR POINTS OF REFERENCE. TOM BROWN'S SCHOOLDAYS, HARD TIMES AND KES PROVIDE MY CONTEXTS: MISS DIBS AND PYGMALION UNDERPIN MY THEORIES OF LEARNING; JUST WILLIAM, TYKE TYLER AND BOY KEEP MY SENSE OF CHILDHOOD ALIVE; AND MISS TRUNCHBALL'S MAXIM "IF IT'S FUN IT ISN'T LEARNING" MAKES ME LAUGH"

JENNY GUBB T.E.S 9TH APRIL 1999

1999 KEITH ATKINSON

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APPENDIX 1

INTRODUCTION

"TOMORROW BELONGS TO THOSE WHO EFFECTIVELY AND CREATIVELY INTERACT WITH TECHNOLOGY TODAY AND DREAM OF POSSIBILITIES FOR TOMORROW"

MADISON COUNTY PUBLIC SCHOOLS, 1998

1999

KEITH ATKINSON

Appendix 1

None

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APPENDIX 2

CONTEXTUAL ISSUES

"KNOWLEDGE WILL FOREVER GOVERN IGNORANCE. AND A PEOPLE WHO MEAN TO BE THEIR OWN GOVERNORS MUST ARM THEMSELVES WITH THE POWER KNOWLEDGE GIVES"

JAMES MADISON, 1822

1999 KEITH ATKINSON

Appendix 2.1

A brief history Of Design & Technology Education

~ from Plato to Callaghan ~

2.2 A brief history of Design and Technological Education ~ from a personal and political viewpoint.

Design & Technology Education ~ from Plato to Callaghan

2.2.1 An etymological study of technology by Custer (1995, p. 221) reveals '*Techne*' as being Aristotelian ~ to do with systematic usage of rules and techniques of effective argument (rhetoric). Hansen and Froelich (1994, pp.197-204) also trace the foundation of the word back to Greek times, '*Technologia*' ~ the systematic treatment of art (*techne* = art, *logis* = treatment of). The German word '*Technik*' ~ the function of man, man-made and natural things and methods of manufacture, came much later. **For an epistomological and historical discussion of Tech Ed (see - *.*.*)**

2.2.2 Several authors trace the roots of technological education back to Plato, including Hansen and Froelich (Op. Cit., p.193), Custer (1995, p.225) and Cross (1986, p.50) :

> "When St Thomas Aquinas defined the objects of education the thirteenth century he adopted the four cardinal virtues of Plato *(prudence, justice, fortitude and temperance)* and added the three Christian virtues *(faith, hope and charity)*....... To St Thomas Aquinas *prudentia* meant 'being realistic, knowing what is practicable' ; *justitia* meant 'being ethical, knowing what is good' ; *fortitudo* meant 'being thorough, knowing what is comprehensive' ; *temperentia* meant 'being economic, knowing when to leave well enough alone."

Reading around the articles above and more widely, I personally arrived at the viewpoint that broadly Plato appeared not to be in favour of the practical, preferring to concentrate on academic knowledge as the route to human fulfilment; *homo sapien* (understander) ruling over *homo faber* (maker), perhaps. **For a discussion of Tech Ed as humanist discipline (see - *.*.*)**

2.2.3 Hansen and Froelich (Op.Cit., p.186) argue that:

> "Aristotle's cardinal definition of technology as phronesis, i.e., practical wisdom, rather than technique, helps one comprehend the elusive mental dimension of technology that does not emerge from historians, anthropologists of sociologists'

Custer (1995, pp. 221-222) further develops the notion of the ideas of Aristotle being central to the development of technological education by postulating that:

> "the conceptual thread of technology as the systematic application of process rules is consistent from Aristotle to the present.'

For a discussion of Tech Ed as volition (see - *.*.*)

2.2.4 One of the joys of study at this level is discovering 'paradoxical nuggets' of information. One such discovery being that for such a 'new' subject on the school curriculum, not only did the word 'technology' originate in ancient Greek, but there is a possibility that Aristotle was one of the earliest proponents of technological education.

2.2.5 In terms of an epistemological analysis of technology education, one can again explore Greek and the Roman culture for the major influences on the development of technological knowledge. Custer (Op. Cit., p225) argues that the dominant attitude towards lower esteem for practical knowledge manifested itself during the domination of these two cultures.

The *'trivium'* ~ grammar, logic and rhetoric, were superceded by a *'quadrivert'* ~ philosophy, arithmetic, geometry and music. In the 19th Century Comte shifted the focus of the emergent *'liberal arts tradition'* of education to a more scientific knowledge base, to create the *'logical positivist tradition'* ~ emphasising mathematics, physics, chemistry and biology, amongst others. **For a discussion of Tech Ed as academic discipline (see - *.*.*)**

2.2.6 Custer (Ibid. p. 221) draws attention to artefacts when charting the historical development of design and technology education. In his discussion he includes Aztec pottery, musical instruments from the Middle-Ages, Renaissance printing, Pyramids and Cathedrals, as well as the modern day artefacts of rockets and satellites. My fascination with the development of technology before science, for example The Great Pyramids at Giza is discussed in the Introductory chapter (see 1.1.1).

For a discussion of Tech Ed as outcome (see - *.*.*), and as process (see - *.*.*).

2.2.7 The next significant influence upon the development of design and technology education in Britain is that of the Industrial Revolution. In an excellent article comparing and contrasting philosophical and practical approaches to technological education in England, France and the United States, Gradwell (1996, pp. 240-243) defines the Industrial Revolution as a social revolution, having profound effects upon the nature and development of education generally, and technological education in particular in England. He posits that the breaking down of complex tasks, and the loosening of worker bonds ('blood ties'), led to 'cruel periods of child labour and worker abuse'. With neither leisure nor recreation, workers and children from 'ordinary' families were largely denied access to meaningful education at all during the Industrial revolution.

2.2.8 Following the Education Act of 1870, establishing the principal of elementary education for all, it seems that the first significant move was made by the City and Guilds Institute to try and have a broadening influence on the type of education available in the 1880's.

2.2.9 The 1902 Education Act established the principle of secondary education, but as these were still paid schools, access was limited, many children had to work for a living and were excluded from education. The establishment of the Junior Technical Schools in 1913, putting onto the curriculum subjects like technical drawing and workshop was the first discrete appearance of technological education on the school curriculum.

2.2.10 Wilson (1992, p.1) suggests that the post-war development of design and technology education is chunked into four stages ~ i) 1945-1970 Craftwork - woodwork, metalwork and technical drawing, ii) From 1970-1990 CDT (Craft, Design and Technology) adding design to craftwork, iii) In 1975 Problem Solving was 'fused' into CDT to add an evaluative feature, and finally iv) the National Curriculum was imposed on schools in 1990. The following (2.2.11 - 2.2.22 and 2.4.1 - 2.4.24 charts the significant historical features as relevant to my perception of design and technology education, and how I practice it in the 1990's.

2.2.11 The First World War provided a hiatus in the development of technological education, as much of the country's school workshop facilities were deployed in preparation of resources for fighting the enemy. It is postulated that the depression of the 1930s led to a virtual standstill in terms of the progression of technological education in Britain, but on the continent, particularly in Germany, the development was accepted and welcomed as a sound investment in the future.

2.2.12 Towards the end of the Second World War the 'Butler' Education Act of 1944 hailed the start of state funded education for all 5 - (eventually)16 year old pupils. This led to the establishment of a tri-partite system of grammar, secondary technical and secondary modern schools. Selective in their set up, the concept behind the scheme was to provide the most appropriate type of education for all pupils.

2.2.13 It can be observed that the grip of the highly academic humanities and scientific lobby had during the development of our education system, and indeed our society throughout the 20th Century, did much to stifle the development of parity of esteem for designing and technological activities, compared to the traditionally strong subjects.

2.2.14 I have always had a problem with the notion that if one has a high IQ then the 'academic' pathway is the correct one, whereas if one were not totally incapable of some academic thought an education in the technical subjects was a good thing. Clearly it can be posited that the standing and perception of engineers and engineering in British society stemmed from this second class schooling label implicit and explicit in the tripartite system.

2.2.15 In 1959 The Crowther Report proved to be a far sighted document. It attempted to raise the profile of technological education, asking consideration be give to:

> the changing social and industrial needs of our society, and the needs of individual citizens, the education of boys and girls between 15 and 18 (the

school leaving age then being 15), and in particular to consider the balance at various levels of general and specialised studies between these ages and to examine the inter-relationship of the various stages of education." Ministry of Education (1959)

2.2.16 Crowther argued persuasively for an 'alternative road' approach for education to enable the country to benefit from the capabilities of all its young people. The Report advocated the rehabilitation of the word 'practical' in educational circles even though it was aware of it's ambiguity : 'practical' carrying pejorative overtones, frequently being construed as being the opposite of 'academic'.

2.2.17 It seems from Penfold's analysis that the vision and professional will existed not to stigmatise the technological curriculum was projected as early as 1956. In many cases the tripartite system became bipartite, with the decline of the secondary technical schools.

2.2.18 This viewpoint that the selective system was failing many pupils and society as a whole was highlighted in the Newsom Report of 1963. Regarding the practical subjects it suggested that they:

> " offer creative and civilising experiences beneficial to all pupils. In urging that they may have additional values for the boys and girls of this report, we are not indulging in the fallacy of supposing that there are two types of pupil, the able and 'academic', and the less able and 'practical' " DFE (1963, p.12)

2.2.19 A significant event to myself, watching as a five year old boy, was the election of Harold Wilson as Prime Minister in 1994. I remember newsreel coverage of his speech on *'the white heat of the technological revolution'* and became keen to learn more about this new idea. My parents were very supportive and encouraging in my desire to know more about technology, even at such a young age. For a further discussion of Wilson's ideas pleas refer to Penfold (Op. Cit., p.36).

2.2.20 In 1965 the circular 10/65 was issued from the DES by Tony Crossland, the then Secretary of State for Education, which led to the widespread creation of comprehensive schools offering entitlement for all pupils. In the years that followed schools and LEA's were given much freedom to develop in whichever way they so chose.

2.2.21 It was not until 1976 (see Penfold, 1987, p.45) that the politicians again interjected into the education debate in any forthright manner. The relationship between the education system and the provision of relevant skills that will serve young citizens and the economy, via industry and the world of work, was again the focal point.

2.2.22 It can be observed that from an analysis of the 1880s up to the late 1970's there was a common theme running through our education system. At several key points the opportunity to promote and enhance technological education, to the benefit of both pupils and the economy, beyond a notion of 'craft for the daft' had failed to be capitalised upon. In the twelve years between Callaghan's speech at Ruskin College and the first attempt at a framework for a national curriculum, there were many initiatives and examples of excellence in technological education that need to be explored as a backdrop to the National Curriculum.

Appendix 2.2

The Pursuit of Excellence in D&T

2.7 2.3 **The Pursuit of excellence in Design and Technology ~ irrespective of politicians and the 'academic cognoscente'**

Design and Technology Education ~ personal influences up to 1988

2.3.1 The development of technological education from a practical standpoint sooner than a scientific/theoretical perspective was first articulated by

2.13

Don Porter right at the start of the establishment of comprehensive schooling in the mid 1960s. Although the politicians and 'academic' educationalists had failed to realise the potential benefits of technological education for all pupils there were several 'pockets of excellence' that existed throughout the country, in spite of the difficulties and entrenched attitudes that were constantly encountered.

2.3.2 As an Undergraduate at Loughborough University in the early 1980s I came under the strong influence of the Leicestershire emphasis of design education, with its roots in the 'Arts and Crafts' movement. A tradition refined by a student of William Morris', Edward Barnsley.

2.3.3 There was a National Association for Design Education (NADE) that had it's roots in the Leicestershire Design movement, partly as a result on all the handicraft teachers trained under the influence of Edward Barnsley at Loughborough College. Barnsley was himself trained and influenced by William Morris and the Arts and Crafts Movement. The physical layout of many 'Creative Design' departments in Leicestershire schools reflected this strong influence. Open plan, integrated, thematic projects, taught to a high standard of design and making were much in evidence.

2.3.4 Bernard Aylward, then 3D Design Adviser in Leicestershire proved to be a leading proponent of the Creative design movement in the 1950s, 60's and 70's. In 1973 Aylward observed that:

> " The ultimate aim of all education should be to help individuals to have a full and satisfying life. This cannot be possible in a complex society without some understanding of the way in which mankind seeks to promote general satisfaction and happiness within that society. In a highly technological world many of the artefacts and systems are the products of industry on a large scale; these seem remote from the individual, and not apparently subject to control, either by individuals or by groups...... Control can only be exercised through knowledge and understanding.

> Hence, in order not to be at the mercy of blind pressures, a knowledge of the way in which decisions are made regarding artefacts and systems is essential to the individuals who make up the community. The making of these decisions is the process called designing. This is the justification for the inclusion of design in the general education of all pupils."
>
> Aylward (1973, p.14)

Much of the language used in this quote is echoed in the 1988 D&T Working Group report on the National Curriculum.

2.3.5 At the same time as the developments within Leicestershire, large scale curriculum development projects were being introduced, each with design as a *modus operandi*. At Keele University, Professor Eggleston was leading the School's Council's 'Research and Development Project in Handicraft'. Goldsmith's College was running the 'Art and Craft 8-13 project' and at the RCA the Keith-Lucas report on 'Design Education at Secondary Level' and the Design Research Department led by Bruce Archer were tireless proponents of the notion that design should be central to the development of all technological education.

2.3.6 I personally believe that history now observes the most significant development in Technological education was a School's Council initiative called 'Project Technology' set up by Geoffrey Harrison, initially at Loughborough College and subsequently at Trent Polytechnic (see Penfold, Op. Cit., pp. 37-38)

2.3.7 Against fierce opposition, not least from existing craft teachers, Harrison's firm belief that technology in schools should be driven through the 'traditional' practical areas has survived, intact, more than three decades later. Much of the good practice, rigour, production of high quality teaching resources and valuable INSET and initial teacher training in the field of technology are directly attributable to the vision and determination of Professor Harrison and his team.

2.3.8 In the late 1970's Lincolnshire LEA appointed Andrew Breckon as it's CDT Adviser. Within the space of a few years, in the early 1980's, Lincolnshire had a complete policy for CDT from 5-18. It had also linked up with Collins the publishers to produce primary, foundation and a series of three GCSE texts that are still widely acknowledged as amongst the best course texts for GCSE's in CDT by practitioners. All of these were written by teams of teachers from Lincolnshire schools, as were a suite of Midlands Examining Group Mode 3 GCSE syllabi for 'Design and Realisation', 'Design and Communication' and 'Technology'. From the mid 1980s up to the early 1990s Lincolnshire became one of the leading authorities in the progression of technology teaching. Andrew Breckon became my advisor when I taught in Lincolnshire. As one of a committed and close knit team of teachers working with Andrew, we helped to generate a wide variety of teacher materials that enabled design and technology to flourish both within Lincolnshire and across the country. My strong commitment to 'A' Level Design and Technology, particularly the London Board (now Edexcel) is a result of this relationship, and also being actively involved in the development of the syllabus over fifteen years, including its philosophical stance.

2.3.9 The Technical and Vocational Education Initiative (TVEI) also made a significant contribution to the philosophical debate about the curriculum identity of technology during it's pilot years from 1982 -1987. Although the initiative has somewhat petered out during it's final 'Extension' years into an exercise in apportioning money for equipment and INSET, the early years were full of optimism, enthusiasm and a good deal of innovative curriculum development. History views TVEI as an important national development in design and technology education.

2.3.10 The broad perspective that TVEI adopted was 'Technology is the disciplined process of using scientific material and human resources to achieve human purpose.' Many schools were organised into clusters and taught modular courses with exciting and relevant subject contents such as : Robotics, Product Design, Manufacturing, Microelectronics, Digital Microelectronics, etc. What TVEI Pilot did for those involved was to allow for genuine, well resourced curriculum development to take place, with time to reflect upon it's implications. As a teacher of TVEI pilot modules whilst at Ashfield Comprehensive School in the latter half of the 1980s I feel I was able to have a positive input into the development of the TVEI programme, mainly at the workshop level.

2.3.11 In 1987 after a TVEI project looking at 'Technology across the curriculum' issues of 'quality and having time to reflect upon developments' were two valued personal benefits stemming directly from the initiative.

2.3.12 In the late 1980s David Layton set the scene for the ensuing debate about the nature of National Curriculum Technology vis-a-vis subject delivery and contributions:

> "As a school subject technology has triple roots in craft (industrial arts), art and design and science. Other contributory subjects can be home economics/domestic science, business studies and information technology (informatics). Although there is more than one version of school technology, the subject has often disconnected itself, or is in the process of doing so, from close relations with it's craft origins. Craft skills remain important, but no longer as ends themselves, to be practised out of context or in artificial, prescribed contexts, until mastery is achieved. They are instead means to the achievement of design goals and subservient to these."
> Layton (1988, p.9)

Appendix 2.3

Contextualising the establishment of a National Framework in Design & Technology

2.3 **2.4** **Contextualising the establishment of a 'National Framework' for Design and Technology.**

Design and Technology Education ~ a personal perspective 1988-1995

2.4.1 Many of the contributors to excellence in technological education throughout recent years, some of whom have been commented upon, were original members of the National Curriculum Design and Technology Working Group, chaired by Lady Parkes.

> "Design team unfurls a high tech umbrella - A gigantic new faculty for design and technology is about to be born in every secondary school which will rival, if not dwarf, the largest English, science and humanities departments. Five specialisms will come under it's umbrella - art and design, business studies, CDT, home economics and information technology" Nash (1989, p.14)

2.4.2 Accordingly, the National Curriculum in Technology was launched, amid much optimism and enthusiasm. The National Design and Technology Education Foundation (NDTEF) launched a pilot scheme in 50 schools nationwide in September 1989.

2.4.3 Ben Kelsey, of the 'Hampshire project' and 'National Business and Information Studies project' outlined the philosophy behind the scheme:

> "Some kind of genuinely integrated and team approach to design and technology is essential, if the national curriculum design courses are to make any educational sense ....The project's approach is a long way from the 'carousel' arrangements that will no doubt mop up the technology curriculum in many schools, with children spending a few weeks in each of three or four departments - CDT, home economics, information technology - without much co-ordination or coherence." Makins (1989, p.20)

2.4.4 This was indeed a bold model, bearing in mind the problems Geoffrey Harrison had encountered in introducing technology to one group of subject specialists, let alone five. Undaunted, the project developed work based on:

> "units focusing on contexts and not on isolated attainment targets, subject disciplines or specific skill training...These units provide a framework within which pupils are able to explore, analyse, generate, produce and evaluate within broad technology activities. The approach throughout is integrated, multi-discipline and continuous, with skills being taught as and when relevant." NDTEF (1989, p.4)

2.4.5 Initial optimism waned and there followed a protracted and damaging territorial battle fought between all five areas.

2.4.6 Art and design eventually disentangled itself, to re-establish as a subject in it's own right once again. There has always been a close association between art and design and D&T in many schools and slowly this is being rebuilt after the straight jacket of the original Statutory Orders in Technology.

2.4.7 Business studies and economic awareness has been increasingly marginalised within the D&T curriculum. That it has a place within the curriculum is not in dispute, neither is the fact that when children design and make things they need to be aware of production costs and wholesale/retail pricing.

2.4.8 The sheer volume of associated statements in the initial Statutory Order of 1990, led to much of the criticism of it being far too complex, and distracting from the basic activities of designing and making:

> "Whilst welcoming the attention given to Business and industrial practices (National Curriculum) Council is of the view that the content of this section of the proposals should be reduced. Work is being carried out to reduce content, and to provide a sharper focus by encouraging work in the contexts of business and industry" Dearing (1993, p.5)

2.4.9 Some Information technology specialists and D&T specialists appeared to be genuinely bemused at the 'Zanussi like' dumping of IT within the Technology document. This had signalled a 'sigh of relief' from many other subjects, who could justifiably argue that it was not part of their subject, its was in the 'green folder'.

2.4.10 The new GCSE Technology syllabi intending to cover all five technology attainment targets, required a minimum of 15% curriculum time, a large 'slice' of an already over consumed 'cake'.

2.4.11 Almost from it's inception the vast majority of IT proponents argued, with justification, that IT is a cross curricular tool and should be taught through all subjects, not just in D&T:

> "(National Curriculum) Council has noted .....that design & technology (D&T) and information technology (IT) are different in nature, and should not be brought together arbitrarily as the National Curriculum subject Technology......Council has also noted the concern expressed..... that, because D&T will typically be taught as a subject, whilst IT capability will be developed across the curriculum, it is unhelpful and misleading for pupils' attainment in D&T and IT to be aggregated for reporting purposes."
> Dearing (Ibid., p.6)

2.4.12 This position, it is observed, was the one well established before the introduction of the national curriculum. Once again in 1995 it appeared to be in the position of being re-adopted in the light of the Dearing Review and the publication of the separate orders for Design & Technology and Information Technology in November 1994.

2.4.13 The place of home economics within technology has perhaps been where the greatest battles were fought. The National Association for Teachers of Home Economics had, since 1988 fought a highly successful and public campaign to keep home economics within the design and technology curriculum. It is postulated by some that whereas woodwork, metalwork and technical drawing teachers were strongly encouraged along a radical road towards CDT many years before by inevitable change, home economics was subjected to less radical change. Theirs, it has been observed, had been a much more evolutionary process up until the introduction of the statutory orders in 1989.

2.4.14 Despite the high profile campaign waged by NATHE, others like Smithers and Robinson - see 2.1.8/9, in the Engineering Council's report 'Getting it right" and the Director of the Engineering Council, Dennis Filer, were outspoken, and successful, in promoting their belief that home economics had no place within National Curriculum Design and Technology.

2.4.15 The DFE and NCC (subsequently SCAA, and latterly the QCA) steered a cautious path through all of the invective. In December 1992, following the Smithers Report in May of the same year the DFE stated:

> "Our proposals recognise the particular opportunities that food and textiles offer as materials for designing and making. However we recognise that some work with food, such as the planning and preparation of family meals, and other aspects of home economics, including the management of resources in the home, consumer education, child development and the study of the family, sit outside the D&T curriculum."
> DFE (1992, p.11)

2.4.16 This view on the place of home economics was further developed in the NCC Consultation Report on Technology in May 1993:

> "Council considers that all pupils should be given the opportunity to work with Food, but has yet been able to resolve whether it is appropriate for this work to take place within technology. Council believes that increased flexibility in the curriculum should allow for life skills such as cooking to be taught alongside National Curriculum subjects."
> Dearing (Op. Cit., p.5)

2.4.17 In September 1993 the place of food within technology was resolved with the publication of the NCC recommendations:

> "that the Secretary of State's proposals present a convincing case for the inclusion of Food technology which combines the study of food as a material for designing and making with the study of the preparation, preservation and packaging processes used by the food industry.....increased flexibility in the curriculum......should allow for important aspects of Home Economics to be taught outside technology. At Key Stage 3 it is acknowledged that some flexibility and choice is desirable, and Council's proposals allow pupils to undertake additional work with compliant materials as an alternative to food technology" NCC (1993, p.8)

2.4.18 At the time this appeared to be an excellent piece of political manoeuvring with everyone getting something, but nobody getting everything. The home economics lobby were incensed at the optional study of food at KS3. Audrey Jones of the Fawcett Society observed:

> "The thinking now seems to be if you can eat it, it can't be technology."
> Dore (1994, p.II)

2.4.19 There were more dispassionate and objective views being expressed:

> "The Association (National Association of Advisers and Inspectors in Design and Technology - NAAIDT-) believed that it was possible to design and make with food and that certain situations require it's use. The activity does not equate with home economics.".
> Round (1994, p.5)

2.4.20 As the dust settled on the Dearing proposals, associations like the Design and Technology Association (DATA), which has come to represent a larger cross section of all D&T enablers, including all specialisms, a more pragmatic and positive approach has been adopted:

> "DATA believes that food technology can make a significant contribution to design and technology as well as to the general education of all pupils.DATA guidance materials will support very positively food technology in addition to resistant and compliant materials"
> Breckon (1995, p.1)

2.4.21 Finally to reinforce the view that food was firmly in the D&T area, but acknowledging it had to jettison much of its other associated baggage, the Calderdale Technology Adviser observed:

> "What can be said, as a result of the recent debate we are now much clearer that it is food as a material which is the concern of technology, not it's other features." Walker (1994, p.II)

2.4.22

> "Many respondents considered that CDT was over represented and that home economics, art and design and business studies were under-represented in the programmes of study for D&T capability". Graham (1989, p.2)

A personal view reveals my feeling that in some respects CDT had sat back looking on in this debacle over individual subject supremacy safe in the knowledge that it has a central role to play, and probably always would have. As indicated earlier, this might be largely due to Professor Harrison enticing many traditional craft teachers to retrain in technology, preparing them for teaching in the 21st century with his 'putting the T into CDT' initiatives at Trent Polytechnic.

2.4.23 The work of the RCA (Keith Lucas report) and others must also be acknowledged in raising craft from a repetitive skill practising exercise into making things that people needed, using design as a vehicle. However, if a subject is to remain viable and at the cutting edge, as technology inevitably is, then constantly striving for excellence and relevance must be an important aim.

2.4.24 Perhaps there is an irony that, although healthy and vigorous debate can make for sound curriculum development, in the six years following the inception of National Curriculum D&T those whom the enablers were supposed to be serving and convincing of its worth : pupils, parents, governors, senior management in schools and outside agencies, often appeared to be confused about the whole subject. As a postscript to this debate I felt very uneasy watching children designing milk and sketching out five different designs for pizzas, the same being true when observing Y7 pupils redesigning a local leisure centre without adequate or meaningful teacher input. These are not biased or patronising observations, merely regretful from both pupil and teacher experiences.

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

APPENDIX 3

TECHNOLOGICAL CAPABILITY

"ONE CANNOT BUILD LIFE FROM REFRIGERATORS, POLITICS, CREDIT STATEMENTS AND CROSSWORD PUZZLES. THAT IS IMPOSSIBLE. NOR CAN ONE EXIST FOR ANY LENGTH OF TIME WITHOUT POETRY, WITHOUT COLOUR, WITHOUT LOVE"

ANTOINE DE SAINT-EXUPÉRY

1999 KEITH ATKINSON

Appendix 3.1

Progression & Assessment

learning has been both informative to this Investigation and to my professional practice.

2.7 Progression and Assessment

Tensions and Paradoxes, Life Long Learning, Differentiation, Post Modernism, Progression and Assessment.

2.7.1.0 Introduction

2.7.1.1 A thought provoking observation from Holcomb (Op. Cit., p.41), suggests that:

> "Schools should be designed to teach children how to cope in an adult society. They must be more than holding pens for students until they become adults, more than just warehouses in which we store kids until they are old enough to tax."

For Handy (Op. Cit., p.51) creating an appropriate climate for education is a pre-cursor to the notion of creating capable students. According to Harris, Wallace and Rudduck (Op. Cit., p.270) pupils need to know: purpose, personal resources, favoured styles, how to articulate, clear objectives and contexts, structure of content and criteria for assessment, before effective learning, progression and assessment can take place.

2.7.1.2 Primary technology as a subject, according to Solomon and Hall (Op. Cit., p.279) is saturated with advice, yet starved of reflection and craft skills. Kimbell (1994b, p.254) pinpoints one reason for this paradox, that there is no universal interpretation of what a technology task is like. That planners and teachers have had different agenda in the last fifteen years has been sadly evident on numerous occasions, not least in the introduction of the National Curriculum in England and Wales a decade ago ~ see 2.4. Solomon and Hall (Op. Cit., p.279) also note that no innovation can succeed if teachers have different objectives to planners.

This is in sharp contrast to the environment of technology teaching that I have enjoyed over the last six years. Kozolanka and Olsen (Op. Cit., p.223) more closely reflect my own situation, when they illustrate the world of the technology teacher as:

> "being a world of teamwork and developing work habits. From childhood to adulthood via a process that renders them employable but more profoundly helps them to become civil."

Dimensions of Personal Development (Everard)

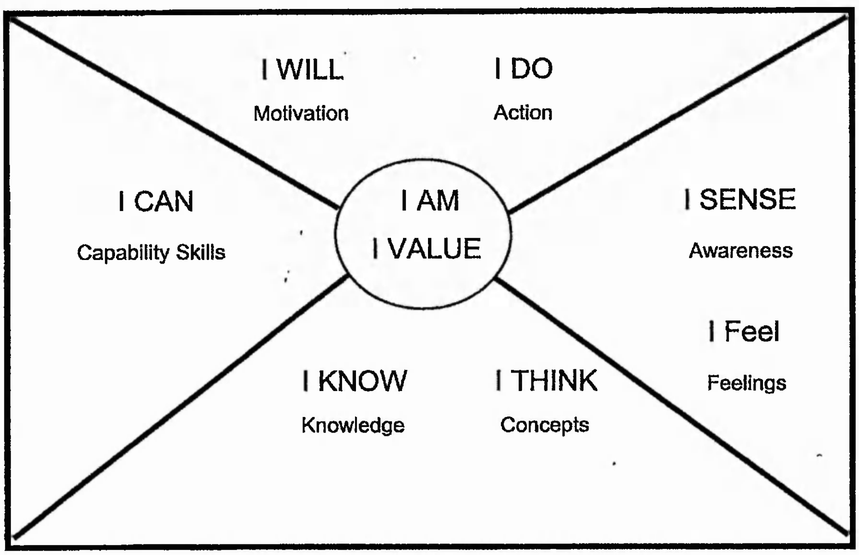

Figure 3

The model proposed by Everard (1993, p.33) places the individual child in the middle of the model, leading the practitioner to consider that when assessing progress one should be mindful of where each child starts from and what type of 'cognoscenti' we should be aiming to 'educe' for life in the twenty-first century. Handy (Op. Cit., p.49) is clear that 'self-sufficiency' is an 'acquired habit'.

2.7.2.0 **Tensions and Paradoxes**

2.7.2.1 Vocational education has appeared recently to have secured greater acceptance within education, perhaps, as a result of the coherent framework that National Vocational Qualifications (NVQ) and General National Vocational Qualifications (GNVQ) have helped to develop via the National Council for Vocational Qualifications (NCVQ).

2.7.2.2 There still exists a tension between the progressive paradigm vocational education finds itself located in, trying to keep up with future needs, but also trying to appease the industrial lobbyists who claim that standards in mathematics and English are in terminal decline. Such a paradox, according to Moore and Hickox (1994, p.288), is mirrored in the 'thatcherist' free-market education policy of the last Tory Government in the late 1980s and early 1990s. Such an approach to education found the right-wing philosopher Roger Scruton aligning himself with the vocationalists, believing that curriculum content should not be left to the whim of the 'free market'.

2.7.2.3 Research conducted by Wellington (Op. Cit., p.310) suggests that what employers actually look for include:

- determination to succeed
- familiarity with I.T.
- independent thinking
- an ability to take responsibility for others
- high levels of technical competence
- high levels of academic achievement
- awareness of the world of work
- to be able to work as part of a team
- work out how to solve problems

and

- be receptive to new ideas

A more constructive approach, I suggest, than cliché ridden observations in the mould of 'fings aint wot they used to be' type polemics so sadly a feature of a system that kept government, employer and educator firmly apart for large amounts of time in the last century of the current millennium.

2.7.3.0 Life Long Learning

2.7.3.1 In the European Union, where students are now taking advantage of greater social mobility, 'Life-Long Learning', according to Horton (Op. Cit., p.209) is concerned with learners realising their potential by increasing their capacity for supported independent study. In the United States of America Montgomery County Public Schools (MCPS) (1999, p.1) suggest that to engage actively in life-long learning students must communicate effectively, obtain and use information and solve problems. Similarly Pike (1995, p.40) suggests education in the future will be geared to help develop self-reliant flexible motivated learners who apply the planning process to support learning. My own philosophy on technology education as it might impact upon life-long learning is captured eloquently by another quote from MCPS (1999, p.1):

> "Technology education prepares students to be life-long learners in a technological society, but most of all it has practical applications and is fun."

2.7.4.0 Differentiation

2.7.4.1 A succinct definition of differentiation, as it applies to education, is given by MacGowan (1998b, p.1):

> "every student is always engaged in an activity that challenges capability and ensures progression."

In the same article MacGowan also cites a body set up by the government in the 1980s to monitor standards, the Assessment of Performance Unit (APU), and offers another emphasis of differentiation as being a complex union of: processes, concepts, knowledge and skills.

2.7.4.2 A personal perspective reveals the underpinning philosophy of differentiation to be sound, but the word itself carried with it political overtones as the 'first round' of Ofsted inspections honed in on the word and, along with the phrase 'on-task' became a means by which schools were subjected to the 'insufficient or flawed evidential base' accumulated and extrapolated by Ofsted ~ see Fitz-Gibbon in the Times Educational Supplement (14th May 1999, p.16). I have mused over what it means to provide differentiation by: resource, support, process, task/project and outcome. As a technologist undoubtedly the major, but not exclusive, means of differentiation is by outcome. MacGowan (1998b, p.4) describes such work as post-task, summative and insufficient. He suggests that if differentiation by process is engaged actively with then it enables key decisions to be balanced between teachers and students. By far the best way of providing differentiation in design and technology, according to MacGowan, is by project, to make capability a goal for all students. Whilst agreeing to this in principle, the practitioner in me reflects back to the workshop I operate in with sixteen vices and GCSE classes of twenty-six. As ever it is a case of balancing the ideal against the attainable, sadly reluctantly jettisoning some valuable baggage *en route*.

2.7.5.0 **Post Modernism**

2.7.5.1 At the point at which I am writing up this Investigation, I claim not to have a full grasp of post-modernism, if indeed it is possible or desirable to do so. I have been exposed to the possibility that there no longer exists the possibility of 'grand narratives' that all must follow. As an educationalist my mind instantly drew a parallel with Government led initiatives like 'literacy project', 'performance related pay' and 'key skills'.

As a practitioner involved in management at departmental and whole school levels, I have analysed the Foucauldian notion of 'micro-circulations of power' and feel able to operate more effectively in committees and at meetings as a result of being aware of this and also Jacque Derrida's notion of deconstruction. This is a tangible benefit of undertaking doctoral level work, specifically taught doctorate, where debate and interaction are intrinsic features.

2.7.5.2 To illustrate the above point Waks (1994, p.45) builds upon the work of Lyotard (1984) and Foucault (1972, 1980) in suggesting that the disappearance of progress within rationality and freedom has led to faith in science being withdrawn, and also that forms of knowledge are components in the development and extension of regimes of social power. Both of the above allude to the absence of universal values and grand narratives.

2.7.6.0 **Progression**

2.7.6.1 The word progress, according to Kimbell (1994a, p.65), implies 'proper' movement in an 'appropriate' direction. Given this premise, Kimbell then offers two further thoughts. Firstly, if people know where they are going they have very different ways of attaining that goal. Secondly to plan progress we need to know the current position of each unique individual. An interesting thought occurred to me whilst I was reflecting upon the meaning of progression, it being ~ Does progression necessarily imply change? Might I as an educationalist have contributed to children progressing from Y7 through to Y11 without having helped them to significantly change? Indeed, Does it matter? Clearly such questions lie beyond the remit of this Investigation, but have stirred a thought in me about something I had somewhat taken for granted.

2.7.6.2 In 'early years education', according to Harris, Wallace and Rudduck (Op. Cit., p.254) the institution is the most important in shaping the individual and not the learning that an individual encounters, the provision of a 'map' being important in such circumstances. In older years there have been attempts to address issues of progression, perhaps notably the Plowden report ~ see 2.5.1.1.4, which addressed issues of child-centered progressivism and the Newsom report which looked at progression in terms of relevance and movement towards employment ~ see 2.2.18.

2.7.6.3 Models of progression, as reflected by my own teacher training in the early 1980s, appear to be based around Piagetian derivatives. Gill and Murray (Op. Cit., p.21)suggest 'Formal Operations' are concerned with manipulating multiple independent variables, varying one at a time. The 'Concrete' stage is seen as being scientific, whilst the 'Formal Operation' stages are concerned with the sorting of different variables in a cogent manner.

2.7.6.4 Progression may be a 3D model, as illustrated by Adey (Op. Cit., p.369)

3D Model of Student Progression

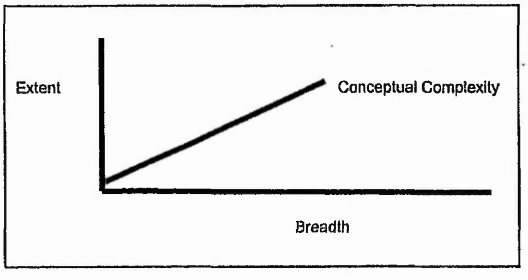

Figure 4

Although this model can be visualised as two-dimensional, Adey intends the axis of extent and breadth to be on the x-y axis, whereas conceptual complexity is intended to be viewed as a point on the x, y and z axes.

The intention is to move away from the notion that simply by filling children up with increasingly complex concepts one can assess progress by plotting breadth against complexity. In acknowledging the possibility of a third dimension of conceptual complexity Adey suggests that together they form a plane which accurately reflects the total amount of knowledge about particular subject matter. For example a student may understand about a range of materials, say woods, metals and plastics, giving breadth. The amount known about each specific material is extent. Only when breadth and extent are considered along with conceptual complexity could we assess what are appropriate materials to be used in designing a wide range of artefacts.

2.7.6.5 My own personal interpretation of the notion of spiralling up, as illustrated by Bruner (1966, p.203) has always conjured up images of cyclonic 3D movement, becoming ever wider as more momentum or experience is gained. For Bruner it is essential that the prerequisits of teachers helping pupils to establish relationships between subject matter and finding means to represent knowledge in specific fields at different stages are satisfied. This view is supported by Kimbell (1994a, p.68) who suggests that educationalists should embrace the paradigm that suggests that what children need at 16 they need as a rising 5 also, albeit in a less complex format. Perry and Danos-Elder (Op. Cit., p.153) calls this an 'encoding hypothesis' where the older benefit from experiences they have constantly encountered at younger ages. In design and technology education Stables (Op. Cit., p.166) conducted research that suggests teacher support levels are the same at Y6 and Y11, perhaps reflecting the notion that similar experiences are encountered, but at somewhat different levels of complexity.

2.7.6.6 Kimbell (1994a, p.66) suggests that progression towards capability implies a kind of 'Sloyd model' ~ see 1.3.7, where the use of a knife as a whittling tool becomes a versatile and powerful tool when possessed by a skilful practitioner ~ see 2.6.6.4. Kimbell (1994b, p.253) further contends in another article that at different National Curriculum Key Stages the nature of design and technological study are different, this needing to be acknowledged in any consideration of progression and assessment. He suggests each Key Stage is about:

- Key Stage 1 ~ Cultural Technology
- Key Stage 2 ~ Problem-Solving Technology
- Key Stage 3 ~ Disciplinary Technology (Bodies of Knowledge)
- Key Stage 4 ~ Simulated Technology

The list is not intended to imply that these are the only activities, or that there are things 'missing', merely that experience suggests that activities at each Key Stage have evolved with the above emphases. My own experience as a family of schools subject co-ordinator and head of department would tend to confirm Kimbell's observations. However not all educationalists share the view that progression is a more amorphous creature than envisaged by the National Curriculum. Solomon and Hall (Op. Cit., p.276) are clear that a 'ladder of skills and competencies' are a necessity if a child's ability to be technologically creative is to be accelerated. In acknowledging the importance of context in education, my own perspective causes me to be unsure as to the effectiveness of such a 'ladder'.

2.7.6.7 In considering progression in relation to learning types, Newby (1995, p.34), discusses eight types, readily acknowledging there may be many more:

- from enacting to representing enactments symbolically
- from simple to more complex skills
- from the local and present to the distant and past or future
- from the past and distant to the present and local
- from single to multiple discriminations

- the progression to conceptual understanding
- from conceptual thinking to problem-solving
- progression in habit development

Adey (Op. Cit., p.387) suggests that as students progress through ‘A’ levels and higher education a complex tree of relationships develops, and that a model to account for this must allow for progress in knowledge extent and also in ability to handle increasingly complex concepts. Such concepts, according to Gagne (1970) are divisible into sub-concepts that allow teachers to define an order of material introduction for learner benefit. This would allow for achievement, according to Kay (Op. Cit., p.41) to possess inclusive criterion based progression with all learners still playing. In design and technology Kimbell (1994b, p.245) suggests that early projects are tightly constrained, with the gradual lessening of constraints to them becoming negotiable and permeable. At GCSE such constraints are loosely controlled, with ‘A’ level being a matter of dialogue with teachers, showing increasing levels of autonomy. This perception correlates quite closely with my own experience.

2.7.7.0 **Assessment**

2.7.7.1 Evaluating the process of learning is difficult according to Shield (Op. Cit., p.4). Stephenson (1993c, p.1) suggests that capability, being a human characteristic is more easily recognised than measured, giving rise to problems of validation, reliability, standards and comparability. There are a number of areas that Stephenson suggests are analagous to the effective observation of capability, such as integration, application, understanding and collaboration. Regarding concrete criteria Stephenson is less convinced but does offer up areas within which useful criteria might be located:

- the formulation of the problem
- the appropriateness of the response
- effective implementation of the response
- evaluation
- the contextual underpinning
- the student's critical review:
  - what has been learnt from the experience
  - what knowledge, skills and personal qualities have developed
  - what proposals are there for continuing development

2.7.7.2 Schön (1996, p.3) cautions about the use of criteria in the assessment of capability, suggesting that self-reflection may be a desirable feature of any assessment system. Although this might be a strange notion I was mindful of a lecture I attended as an undergraduate in the early 1980s in which an engineer from BMW, the motor manufacturer, was quoted as saying that quality is impossible to define but you know when you have got it.

2.7.7.3 When teaching 'A' level students one aim is to encourage the use of independent study. Graves (1993, p.95) drew up a list of criteria that I have found useful as a practitioner, to inform judgements that my 'A' level team make when assessing project work in the VI Form:

- imagination/originality
- understanding and competence
- critical judgement
- communication skills
- synthesising capacity and ability to relate to practice
- broad cognitive perspective

2.7.7.4 As an experienced teacher I have viewed sceptically the move towards tick lists in establishing a grade for design and technology coursework.

After fifteen years the most successful method of marking and moderating work is to assemble all staff who have taught the subject, getting each teacher to rank their own group's folders. The next stage is to intercut each group into a growing consensual spine of folders that colleagues dip into continually to arrive at an agreed order. Such a process takes six hours over two evenings. Associated practical work is assessed in a similar fashion, only taking an evening to complete. My model is based on pragmatism and holism and has served over fifteen years to provide outcomes that have seldom needed much adjustment in the final analysis. In evolving my/my team's system of assessment I have drawn on the work of Kimbell (1994a, pp.74-77) who both notes and cautions about the use of atomised assessment.

2.7.7.5 Also of use to me when reviewing assessment methods was an article by Hall (Op. Cit., p.54) which observes that teachers appear to be well aware of formative assessment, but seemed reluctant to use such method. My own experience is that I would, given class sizes and time that would allow for such instruments, relish the opportunity to deploy such a beneficial tool. The article also draws attention to the fact that teachers are the cornerstone of any systematic reform, something I have drawn great strength from throughout my teaching career.

2.7.7.6 Regarding assessment specifically within design and technology, Layton (1995, p.105) notes that, in the absence of a new assessment culture to match the new capability thrust of the subject, this is an issue that over the last few years has been somewhat 'problematical'. Kyriacou and Wilkin (1993, pp.270-274) suggest that too narrow a focus for assessment caused great difficulties.

2.7.7.7 Operating against a constantly changing knowledge base, the technology education paradigm, according to Stemnet (1998, p.1), implies certain continuous assessment modes, like the knowledge of certain concepts/processes, the development and use of new technologies, the transfer of knowledge and skills to new situations and the consequences of technological actions. Such assessment it is suggested must take substantive account of these facets of technological education.

2.7.7.8 For Gill and Murray (Op. Cit., p.22) design and technology in the 'real world' presents difficulties by the implicit introduction of non-quantifiable variables such as aesthetics of design, but does key into another important point already made about the importance of the classification of variables ~ see 2.7.6.3.

2.7.7.9 In drawing up my research instrument to use in cycle 1 of my action research programme, question 9 of the staff and student questionnaires makes extensive use of the work of the Newfoundland and Labrador Department of Education (1998d, p.2) done on assessment procedures. They offer up seventeen assessment modes in acknowledgement that design and technology assessment is far from a simple matter. They suggest that relevant assessment modes include:

- observation
- written test
- model construction
- prototyping
- designing/constructing equipment
- system design/construction
- illustration
- presentation
- assignment
- research
- class participation
- sketching/illustrating
- technical drawing
- production of a design portfolio

- interview
- student self-assessment

and

- peer assessment

It is suggested that the above can be categorised into one of four areas: factual knowledge, conceptual understanding, problem-solving skills and practical performance of a wide variety of technological activities. Regarding one of the categories highlighted, Cowan (Op. Cit., p.6) suggests that the need for students to assess their own and others technology work is essential if capability is to be striven for.

2.7.7.10 Graves (Op. Cit., p.93) suggests that when assessing the products and processes of student participation in design and technological activities, the following proportions are applicable:

- 10% ~ for formulation
- 20% ~ for planning the study
- 20% ~ for coursework
- 30% ~ for dissertation work
- 20% ~ for critical review

Being a North American model, not all categories are readily transferable, such as the absence of a dissertation in most design and technology courses in England and Wales.

2.7.7.11 A final thought on assessment of participative interaction is provided by Schön (1996, p.4) who suggests that 'optimisation to measures' represents the future for assessment of performance capability. This idea suggests that the organisational setting in which problems are established provide the key to purposeful assessment. In making this point Schön thinks that it is vital that we distinguish between the indescribable and the undiscussable.

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

APPENDIX 4

METHODOLOGY

"WE HAVE NO ART, WE JUST DO THINGS AS WELL AS WE CAN"

BALINESE PROVERB

1999

KEITH ATKINSON

Appendix 4.1

Student Questionnaire

Student Questionnaire on 'A' Level Design & Technology

The aim of this questionnaire is to find out your opinions and views on some important issues concerning the teaching and learning of design and technology.

My research is partly to do with looking at how the local community and environment affects the work done in design and technology lessons. I am visiting schools in both suburban and rural contexts. I am interested in this area of study as I was born in an urban setting, grew up in a rural community and now teach in the suburbs of a city.

All of the 'A' Level Design & Technology syllabuses mention *capability* as something they aim to develop in students. The National Curriculum in Design & Technology, that you did at GCSE level also aimed to develop this. As a follow up to you completing this questionnaire I would like to discuss and explore with you what 'capability' might mean in some detail.

Please do not feel the urge to be 'clued up' before our discussion, I am not looking for right or wrong answers. I genuinely wish to find out what you think about the issues that I am keen to explore with you.

The questionnaire has a total of 15 questions, organised into 8 sections.

Section 1 - Background information	Questions 1-3
Section 2 - Characteristics of D&T	Questions 4-6
Section 3 - Knowledge & Processes used in D&T	Questions 7-8
Section 4 - Assessment	Question 9
Section 5 - Capability	Questions 10-11
Section 6 - Your journey from Y7 to the VI Form	Question 12
Section 7 - School in general	Question 13
Section 8 - School specific details	Questions 14-16

If we could subsequently meet as a group to talk about these and other issues I would be most grateful.

Total confidentiality and anonymity is a condition of me being able to conduct the research. Should you wish not to take part, or withdraw from the research when in progress you have an absolute right to do so. Any participant will be coded, known only to myself, so that individuals cannot be identified when reading the findings of my research. The same approach applies to the identity of the school. Each participant (student and teacher) along with the Head Teacher will view the findings and written comments prior to publication, retaining the right to edit or remove any references should they consider them to be inappropriate or enable the identity of the school to be revealed.

Thank you in anticipation of your help.

Keith Atkinson Nottingham Trent University April 1999

Student Questionnaire

Section 1 - BACKGROUND INFORMATION

1. What combination of subjects are you studying?

______________________ ______________________

______________________ ______________________

2. What were the main reasons you chose D&T as a subject to study at 'A'/'AS' Level?

(please number your TOP 3 ONLY number 1 being the most important, number 2 being the second most important etc.)

a	I enjoyed the subject at GCSE	[ ]
b	Because of the teacher	[ ]
c	Fitted in well with other choices for University application	[ ]
d	I gained a good Grade at GCSE	[ ]
e	Because the skills and knowledge gained in D&T are useful	[ ]
f	Recommended to by my teacher	[ ]
g	Recommended to by my careers officer	[ ]
h	My parents thought it a good idea when they discussed it with me	[ ]
i	Good reputation for high standard of results	[ ]

3. Do you have an intended career path at this time? Yes [ ] No [ ]

If yes, please give any details ______________________

____

____

4. Have you been at your present school from Y7 ? **Yes [ ]**
No [ ]

If no please indicate whether you previous school was: Urban [ ]
(please tick one only) Rural [ ]
Suburban [ ]

Section 2 - CHARACTERISTICS OF Design & Technology

People appear to have strong views about technology.

5. Technology to me is:

(please place a cross somewhere on each scale line to represent where your current views tend towards. The further from the centre, the more you agree with the phrase at the left or right hand end)

Knowing 'that'	←|——|——|——|——|——|——|→	Knowing 'how'
Pure Arts	←|——|——|——|——|——|——|→	Pure Sciences
'Learning' Knowledge	←|——|——|——|——|——|——|→	'Using' Knowledge
Atomised	←|——|——|——|——|——|——|→	Holistic
Deterministic (Inevitable)	←|——|——|——|——|——|——|→	Emancipatory (Freedom seeking)
Stability	←|——|——|——|——|——|——|→	Change

6. Specific Characteristics of D&T

What is your view on each of the following statements about D&T?

(please tick the column that most closely reflects your view of each specific statement.)

		Strongly Agree	Agree	No Strong View	Disagree	Strongly Disagree
a	Uses Scientific Knowledge	[ ]	[ ]	[ ]	[ ]	[ ]
b	Allows the transfer of knowledge to new situations	[ ]	[ ]	[ ]	[ ]	[ ]
c	Not all D&T knowledge can be written down	[ ]	[ ]	[ ]	[ ]	[ ]
d	Applies mathematical concepts	[ ]	[ ]	[ ]	[ ]	[ ]
e	Knowledge has to be learnt by 'rote'	[ ]	[ ]	[ ]	[ ]	[ ]
f	Knowledge is used to solve problems	[ ]	[ ]	[ ]	[ ]	[ ]
g	Being creative with ideas	[ ]	[ ]	[ ]	[ ]	[ ]
h	Learning through making	[ ]	[ ]	[ ]	[ ]	[ ]
i	Is about balancing Function with Aesthetics	[ ]	[ ]	[ ]	[ ]	[ ]
j	<u>Must</u> involve making	[ ]	[ ]	[ ]	[ ]	[ ]
k	Always a balance between 'thinking' and 'doing'	[ ]	[ ]	[ ]	[ ]	[ ]
l	Thinking thoughtfully and carefully (deeply/widely)	[ ]	[ ]	[ ]	[ ]	[ ]
m	Is <u>always</u> purposeful	[ ]	[ ]	[ ]	[ ]	[ ]
n	Requires reflection on what is important	[ ]	[ ]	[ ]	[ ]	[ ]
o	Is about giving and taking all forms of criticism	[ ]	[ ]	[ ]	[ ]	[ ]
p	Co-operating with others	[ ]	[ ]	[ ]	[ ]	[ ]
q	Collaborating with others	[ ]	[ ]	[ ]	[ ]	[ ]
r	Considering the needs of others	[ ]	[ ]	[ ]	[ ]	[ ]
s	Working towards compromises	[ ]	[ ]	[ ]	[ ]	[ ]
t	Overcoming prejudices	[ ]	[ ]	[ ]	[ ]	[ ]
u	Is about making a positive impact on society	[ ]	[ ]	[ ]	[ ]	[ ]
v	Often has a negative impact on society	[ ]	[ ]	[ ]	[ ]	[ ]
w	Beliefs and values are important when doing D&T	[ ]	[ ]	[ ]	[ ]	[ ]
x	Helps teach people to cope in a changing world	[ ]	[ ]	[ ]	[ ]	[ ]
y	Honesty is important	[ ]	[ ]	[ ]	[ ]	[ ]
z	Integrity is important	[ ]	[ ]	[ ]	[ ]	[ ]
aa	Concerns guarding the earth's resources	[ ]	[ ]	[ ]	[ ]	[ ]
bb	Developing quality products that work	[ ]	[ ]	[ ]	[ ]	[ ]
cc	Developing a wide range of communication skills	[ ]	[ ]	[ ]	[ ]	[ ]
dd	Teaches people to be independent thinkers	[ ]	[ ]	[ ]	[ ]	[ ]
ee	Gradually changes dependent learners into self-motivated individuals	[ ]	[ ]	[ ]	[ ]	[ ]
ff	Skills gained are transferable	[ ]	[ ]	[ ]	[ ]	[ ]
gg	Develops autonomy	[ ]	[ ]	[ ]	[ ]	[ ]
hh	Is a 'linear process' that moves from the 'simple' to the 'complex'	[ ]	[ ]	[ ]	[ ]	[ ]
ii	Making money through D&T activities is important	[ ]	[ ]	[ ]	[ ]	[ ]
jj	Skills gained are useful when looking for a job	[ ]	[ ]	[ ]	[ ]	[ ]

		Strongly Agree	Agree	No Strong View	Disagree	Strongly Disagree
kk	Being able to 'troubleshoot' problems	[ ]	[ ]	[ ]	[ ]	[ ]
ll	Teaches us to be sensible about the things that cannot be changed	[ ]	[ ]	[ ]	[ ]	[ ]
mm	Predicting patterns and sequences is important	[ ]	[ ]	[ ]	[ ]	[ ]
nn	Teaches us to summarise things effectively	[ ]	[ ]	[ ]	[ ]	[ ]
oo	Allows us to make informed comparisons	[ ]	[ ]	[ ]	[ ]	[ ]

Section 3 - KNOWLEDGE & PROCESSES USED IN Design &Technology

7. D&T Knowledge is:

(please give each comment a score from 1 to 5,
1 if you agree strongly, 5 if you disagree strongly)

a	Transferable	[ ]
b	Mainly facts	[ ]
c	Descriptive	[ ]
d	Tacit ~ (developed only by doing)	[ ]
e	Prescriptive ~ (about the process of improvement)	[ ]

8. D&T Processes are about:

(please give each comment a score from 1 to 5,
1 if you agree strongly, 5 if you disagree strongly)

a	Creativity and Inventiveness	[ ]
b	Transforming things	[ ]
c	Controlling things	[ ]
d	Producing things	[ ]
e	Maintaining & Using things	[ ]

Section 4 - ASSESSMENT

9. Assessment Procedures in Design & Technology.

Which of the following are the most accurate ways of assessing how 'good' someone is at D&T?

(please number your TOP 5 ONLY number 1 being the most important, number 2 being the second most important etc.)

a	Being observed by the teacher	[ ]
b	Written test	[ ]
c	Constructing models	[ ]
d	Prototyping	[ ]
e	Designing systems	[ ]
f	Illustrating/Sketching	[ ]
g	Presenting	[ ]
h	Writing assignments	[ ]
i	Researching	[ ]
j	Class participation	[ ]
k	Technical Drawing	[ ]
l	Interviewing	[ ]
m	Self-assessment	[ ]
n	Peer group assessment	[ ]

Section 5 - CAPABILITY

10. Technological Literacy
Please identify which you think are most important when observing, discussing or writing about D&T.

(please place the following in rank order from 1 to 7, 1 being the most important, 2 being the second most important etc.)

a	Citizenship ~ people reflecting on the needs of society	[ ]
b	Effectively articulating technological vocabulary and concepts	[ ]
c	Applying mathematical and scientific concepts	[ ]
d	People reading and writing technological materials (essays, etc.)	[ ]
e	Using networks of communications both efficiently and effectively	[ ]
f	Thinking logically and being able to sequentially programme	[ ]
g	Making informed decisions about technological issues	[ ]

11. Technological Capability

The following statements describe what technologically capable people are able to do.

(please tick all statements that you think are true)

a	Recognise that problems need solutions	[ ]
b	Develop and evaluate alternative ideas and solutions	[ ]
c	Select, optimise and apply knowledge and resources to practical problems	[ ]
d	Work with imposed constraints and limited resources	[ ]
e	Assess effectiveness of technological solutions from various perspectives	[ ]
f	Make value judgements regarding actions whilst solving problems	[ ]
g	Feel comfortable learning about tools/systems in home/leisure/work contexts	[ ]
h	Understand the nature and role of technology in a rapidly changing world	[ ]
i	Understand how technological systems are designed, used and controlled	[ ]
j	Able to quantify benefits and assess the risks associated with technology	[ ]
k	Able to respond rationally to ethical or moral dilemmas caused by technology	[ ]

SECTION 6 - MAKING PROGRESS - THE JOURNEY FROM Y7 TO THE VI FORM

12. Progression

Comparing and contrasting your work in D&T now to that which you did in Year 7, which would characterise the work most accurately for the two age groups.

(please tick all that apply to the Y7 column and the VI Form column)

		Year 7	VI Form
a	Divergent thinking	[ ]	[ ]
b	Extensive use of your own Initiative	[ ]	[ ]
c	Convergent thinking	[ ]	[ ]
d	Relying on the teacher	[ ]	[ ]
e	Treating the teacher as a guide or 'mentor'	[ ]	[ ]
f	Treating the teacher as an equal partner	[ ]	[ ]
g	Treating the teacher as consultant	[ ]	[ ]
h	Treating the teacher as source of knowledge	[ ]	[ ]
I	Being given problems to solve	[ ]	[ ]
j	Finding problems to solve	[ ]	[ ]

Section 7 - REGARDING SCHOOL IN GENERAL

Q13. Are there any instances you can think of where consideration of your local environment has been important in your work between Y7 and Y11 in any school subject? **Yes [ ]** **No [ ]**

If yes, please give as much detail as possible ______________________________

____

____

____

DESIGN & TECHNOLOGY - SCHOOL SPECIFIC DETAILS

14. Please list examples of the types of project done in D&T lessons during your time in secondary education.

(in the brackets under each line please give details of the main materials used in each project, e.g. food, wood, electronics, metal, textiles, plastics, etc.)

Y7 ______________________ Y7 ______________________

[ ] [ ]

Y7 ______________________ Y7 ______________________

[ ] [ ]

Y8 ______________________ Y8 ______________________

[ ] [ ]

Y8 ____________________ Y8 ____________________

[ ] [ ]

Y9 ____________________ Y9 ____________________

[ ] [ ]

Y 9 ____________________ Y9 ____________________

[ ] [ ]

Y10 ____________________ Y10 ____________________

[ ] [ ]

Y10 ____________________ Y10 ____________________

[ ] [ ]

Y11 ____________________ Y11 ____________________

[ ] [ ]

L VI ____________________ L VI ____________________

[ ] [ ]

U VI ____________________ U VI ____________________

[ ] [ ]

15. Which, if any of the projects you have highlighted above, involved thinking about your community and designing and/or making something to be used locally or by people you know?

16. Please give any details of projects where you have been encouraged to 'put yourself in other peoples shoes' when designing and making technological artefacts.

Many thanks in anticipation of your help.

Please feel free to miss out any questions you do not wish to answer.

Keith Atkinson April 1999

Appendix 4.2

Staff Questionnaire

Staff Questionnaire on 'A' Level Design & Technology

The aim of this questionnaire is to find out your opinions and views on some important issues concerning the teaching and learning of design and technology.

My research is partly to do with looking at how the local community and environment affects the work done in design and technology lessons. I am visiting schools in both suburban and rural contexts. I am interested in this area of study as I was born in an urban setting, grew up in a rural community and now teach in the suburbs of a city.

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Please do not feel the urge to be 'clued up' before our discussion, I am not looking for right or wrong answers. I genuinely wish to find out what you think about the issues that I am keen to explore with you.

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Section 3 - Thinking, Knowledge & Processes used in D&T	Questions 6-8
Section 4 - Assessment	Question 9-10
Section 5 - Capability	Questions 11-12
Section 6- School in general	Question 13
Section 7 - School specific details	Questions 14-16

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Total confidentiality and anonymity is a condition of me being able to conduct the research. Should you wish not to take part, or withdraw from the research when in progress you have an absolute right to do so. Any participant will be coded, known only to myself, so that individuals cannot be identified when reading the findings of my research. The same approach applies to the identity of the school. Each participant (student and teacher) along with the Head Teacher will view the findings and written comments prior to publication, retaining the right to edit or remove any references should they consider them to be inappropriate or enable the identity of the school to be revealed.

Thank you in anticipation of your help.

Keith Atkinson Nottingham Trent University April 1999

Staff Questionnaire

Section 1 - BACKGROUND INFORMATION

1. **What combination of material specialisms do you offer within D&T?**

_______________ _______________

_______________ _______________

_______________ _______________

_______________ _______________

2. **Have long have you been at your present school ?**

0-2 years [ ]
3-5 years [ ]
5-10 years [ ]
over 10 years [ ]

3. **Which of the following types of school have you worked in?**

Urban [ ]
Rural [ ]
Suburban [ ]

Section 2 - CHARACTERISTICS OF Design & Technology

People appear to have strong views about technology.

4. Technology to me is:

(please place a cross somewhere on each scale line to represent where your current views tend towards. The further from the centre, the more you agree with the phrase at the left or right hand end)

Knowing 'that'	Knowing 'how'
Pure Arts	Pure Sciences
'Learning' Knowledge	'Using' Knowledge
Atomised	Holistic
Deterministic (Inevitable)	Emancipatory (Freedom seeking)
Stability	Change

5. Specific Characteristics of D&T

What is your view on each of the following statements about D&T?

(please tick the column that most closely reflects your view of each specific statement.)

		Strongly Agree	Agree	No Strong View	Disagree	Strongly Disagree
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b	Allows the transfer of knowledge to new situations	[ ]	[ ]	[ ]	[ ]	[ ]
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d	Applies mathematical concepts	[ ]	[ ]	[ ]	[ ]	[ ]
e	Knowledge has to be learnt by 'rote'	[ ]	[ ]	[ ]	[ ]	[ ]
f	Knowledge is used to solve problems	[ ]	[ ]	[ ]	[ ]	[ ]
g	Being creative with ideas	[ ]	[ ]	[ ]	[ ]	[ ]
h	Learning through making	[ ]	[ ]	[ ]	[ ]	[ ]
i	Is about balancing Function with Aesthetics	[ ]	[ ]	[ ]	[ ]	[ ]
j	Must involve making	[ ]	[ ]	[ ]	[ ]	[ ]
k	Always a balance between 'thinking' and 'doing'	[ ]	[ ]	[ ]	[ ]	[ ]
l	Thinking thoughtfully and carefully (deeply/widely)	[ ]	[ ]	[ ]	[ ]	[ ]
m	Is always purposeful	[ ]	[ ]	[ ]	[ ]	[ ]
n	Requires reflection on what is important	[ ]	[ ]	[ ]	[ ]	[ ]
o	Is about giving and taking all forms of criticism	[ ]	[ ]	[ ]	[ ]	[ ]
p	Co-operating with others	[ ]	[ ]	[ ]	[ ]	[ ]
q	Collaborating with others	[ ]	[ ]	[ ]	[ ]	[ ]
r	Considering the needs of others	[ ]	[ ]	[ ]	[ ]	[ ]
s	Working towards compromises	[ ]	[ ]	[ ]	[ ]	[ ]
t	Overcoming prejudices	[ ]	[ ]	[ ]	[ ]	[ ]
u	Is about making a positive impact on society	[ ]	[ ]	[ ]	[ ]	[ ]
v	Often has a negative impact on society	[ ]	[ ]	[ ]	[ ]	[ ]
w	Beliefs and values are important when doing D&T	[ ]	[ ]	[ ]	[ ]	[ ]
x	Helps teach people to cope in a changing world	[ ]	[ ]	[ ]	[ ]	[ ]
y	Honesty is important	[ ]	[ ]	[ ]	[ ]	[ ]
z	Integrity is important	[ ]	[ ]	[ ]	[ ]	[ ]
aa	Concerns guarding the earth's resources	[ ]	[ ]	[ ]	[ ]	[ ]
bb	Developing quality products that work	[ ]	[ ]	[ ]	[ ]	[ ]
cc	Developing a wide range of communication skills	[ ]	[ ]	[ ]	[ ]	[ ]
dd	Teaches people to be independent thinkers	[ ]	[ ]	[ ]	[ ]	[ ]
ee	Gradually changes dependent learners into self-motivated individuals	[ ]	[ ]	[ ]	[ ]	[ ]
ff	Skills gained are transferable	[ ]	[ ]	[ ]	[ ]	[ ]
gg	Develops autonomy	[ ]	[ ]	[ ]	[ ]	[ ]
hh	Is a 'linear process' that moves from the 'simple' to the 'complex'	[ ]	[ ]	[ ]	[ ]	[ ]
ii	Making money through D&T activities is important	[ ]	[ ]	[ ]	[ ]	[ ]
jj	Skills gained are useful when looking for a job	[ ]	[ ]	[ ]	[ ]	[ ]

		Strongly Agree	Agree	No Strong View	Disagree	Strongly Disagree
kk	Being able to 'troubleshoot' problems	[ ]	[ ]	[ ]	[ ]	[ ]
ll	Teaches us to be sensible about the things that cannot be changed	[ ]	[ ]	[ ]	[ ]	[ ]
mm	Predicting patterns and sequences is important	[ ]	[ ]	[ ]	[ ]	[ ]
nn	Teaches us to summarise things effectively	[ ]	[ ]	[ ]	[ ]	[ ]
oo	Allows us to make informed comparisons	[ ]	[ ]	[ ]	[ ]	[ ]

Section 3 - THINKING, KNOWLEDGE & PROCESSES USED IN D &T

6. D&T Knowledge is:

(please give each comment a score from 1 to 5,
1 if you agree strongly, 5 if you disagree strongly)

a	Transferable	[ ]
b	Mainly facts	[ ]
c	Descriptive	[ ]
d	Tacit ~ (developed only by doing)	[ ]
e	Prescriptive ~ (about the process of improvement)	[ ]

7. D&T Processes are about:

(please give each comment a score from 1 to 5,
1 if you agree strongly, 5 if you disagree strongly)

a	Creativity and Inventiveness	[ ]
b	Transforming things	[ ]
c	Controlling things	[ ]
d	Producing things	[ ]
e	Maintaining & Using things	[ ]

8. The following 'intelligencies' are relevant to D&T:

(please give each comment a score from 1 to 5, 1 if you agree strongly, 5 if you disagree strongly)

a	Linguistic ~ read write and communicate	[ ]
b	Logical/Mathematical ~ identify and solve problems	[ ]
c	Spatial ~ express ideas (design, draw, prototype)	[ ]
d	Bodily ~ kinaesthetic (construct, manipulate environments and devices)	[ ]
e	Interpersonal ~ organise and manage group responses & problem situations	[ ]
f	Intrapersonal ~ set personal goals and work independently	[ ]

Section 4 - ASSESSMENT

9. Assessment Procedures in Design & Technology.

Which of the following are the most accurate ways of assessing how 'good' someone is at D&T?

(please number your TOP 5 ONLY number 1 being the most important, number 2 being the second most important etc.)

a	Teacher observation	[ ]
b	Written test	[ ]
c	Constructing models	[ ]
d	Prototyping	[ ]
e	Designing systems	[ ]
f	Illustrating/Sketching	[ ]
g	Presenting	[ ]
h	Writing assignments	[ ]
i	Researching	[ ]
j	Class participation	[ ]
k	Technical Drawing	[ ]
l	Interviewing	[ ]
m	Self-assessment	[ ]
n	Peer group assessment	[ ]

10. The philosophies underpinning student assessment are often diverse.

As a practising teacher, how would you rate each of these approaches?

(please give each comment a score from 1 to 5,
1 if you agree strongly, 5 if you disagree strongly)

a Evaluative ~ relative to outcomes and performance [ ]
b Reflective ~ covering the activity based nature of the subject [ ]
c Understanding ~ observing the strategic or technological changes [ ]
d Continuous ~ 'on the hoof', holistic, mental constructions [ ]

Section 5 - CAPABILITY

11. Technological Literacy

Please identify which you think are most important when observing, discussing or writing about D&T.

(please place the following in rank order from 1 to 7,
1 being the most important, 2 being the second most important etc.)

a Citizenship ~ people reflecting on the needs of society [ ]
b Effectively articulating technological vocabulary and concepts [ ]
c Applying mathematical and scientific concepts [ ]
d People reading and writing technological materials (essays, etc.) [ ]
e Using networks of communications both efficiently and effectively [ ]
f Thinking logically and being able to sequentially programme [ ]
g Making informed decisions about technological issues [ ]

12. Technological Capability

The following statements describe what technologically capable people are able to do.

(please tick all statements that you think are true)

a	Recognise that problems need solutions	[ ]
b	Develop and evaluate alternative ideas and solutions	[ ]
c	Select, optimise and apply knowledge and resources to practical problems	[ ]
d	Work with imposed constraints and limited resources	[ ]
e	Assess effectiveness of technological solutions from various perspectives	[ ]
f	Make value judgements regarding actions whilst solving problems	[ ]
g	Feel comfortable learning about tools/systems in home/leisure/work contexts	[ ]
h	Understand the nature and role of technology in a rapidly changing world	[ ]
i	Understand how technological systems are designed, used and controlled	[ ]
j	Able to quantify benefits and assess the risks associated with technology	[ ]
k	Able to respond rationally to ethical or moral dilemmas caused by technology	[ ]

Section 6 - REGARDING SCHOOL IN GENERAL

Q13. Are there any instances you can think of where children are encouraged to consider the local environment when doing D&T?

Yes [ ]
No [ ]

If yes, please give as much detail as possible ______________________

____

____

____

____

____

____

Section 7 - DESIGN & TECHNOLOGY - SCHOOL SPECIFIC DETAILS

14. Please list examples of the types of project you undertake with students in D&T lessons.

(in the brackets under each line please give details of the main materials used in each project, e.g. food, wood, electronics, metal, textiles, plastics, etc.)

Y7 ______________________ Y7 ______________________

[______________________] [______________________]

Y7 ______________________ Y7 ______________________

[______________________] [______________________]

Y8 ______________________ Y8 ______________________

[______________________] [______________________]

Y8 ______________________ Y8 ______________________

[______________________] [______________________]

Y9 ______________________ Y9 ______________________

[______________________] [______________________]

Y 9 ______________________ Y9______________________

[______________________] [______________________]

Y10 ______________________ Y10______________________

[______________________] [______________________]

Y10 ______________________ Y10______________________

[______________________] [______________________]

Y11 ______________________ Y11______________________

[______________________] [______________________]

L VI ______________________ L VI______________________

[______________________] [______________________]

U VI______________________ U VI______________________

[______________________] [______________________]

15. Which, if any of the projects you have highlighted above, involve thinking about your community and designing and/or making something to be used locally or by people you know?

____

____

____

16. Please give any details of projects where you encourage students to 'put themselves in other peoples shoes' when designing and making technological artefacts.

Many thanks in anticipation of your help.

Please feel free to miss out any questions you do not wish to answer.

Keith Atkinson April 1999

Appendix 4.3

Data Capture Form

ACTION RESEARCH CYCLE II ~ TAPED INTERVIEW

Area Of Focus ______________________________ Date ____/____/____ Sheet No. ______ ______

Issue Discussed	Tape No.	Tape Counter	Staff/Stude nt Code	Quotation	Additional Info.

KA Notes ____

____

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

APPENDIX 5

ANALYSIS

"SOME PEOPLE SEE THINGS AS THEY ARE AND SAY 'WHY'? I DREAM THINGS THAT NEVER WERE AND ASK 'WHY NOT'?"

ROBERT FITZGERELD KENNEDY 1968

1999 KEITH ATKINSON

Appendix 5.1

Student Questionnaire Responses

May 1999 **Student Questionnaire Analysis** 1st May 1999.

* Ruralis Sch = 6 Returns
* 86% Return
* $\frac{1}{6}$ Female = 17%
* $\frac{5}{6}$ Male = 83%

* Suburbia Sch = 3 Returns
* 75% Return
* $\frac{1}{3}$ Female = 33%
* $\frac{2}{3}$ Male = 67%.

Student Questionnaire Analysis

① 'A' Level Choices ~ Both schools Ar, En, DT.
Only Suburbia Ma, Ph, DT.
Only Ruralis Gen Studs.

② Main reasons for choosing DT at 'A' Level
Ruralis ~ Enjoy, Grade.
Suburbia ~ Enjoy.

③ Intended Career Yet?
Ruralis ~ Designers, Teacher.
Suburbia ~ RAF Engineer.

④ Been at School since Y7?
Ruralis ~ 5/6 one urban.
Suburbia ~ 3/3

⑤	Ruralis	Suburbia	Variance
a) That vs How	4·7	4·5	-·2
b) Arts vs Sciences	4·3	4·5	+·2
c) 'Learn' vs 'Use'	4·5	3·5	-1·0
d) Atomise vs Holistic	4·2	4·1	-·1
e) Determin. vs Emancip.	5·3	4·5	-·8
f) Stability vs Change	4·5	5·5	+1·0

General consensus on 'That' vs 'How', 'Arts' vs 'Sciences' and 'Atomised' vs 'Holistic'. Ruralis Students seemed to regard D&T as freedom seeking, Suburbia Students tend towards emancipato but only slightly from centre. Suburbia students tend toward 'Learn' knowl, 'Ruralis' students tend towards 'Use' knowledge. Suburbia students see Tech as agency to 'change', as do Ruralis student, but to a less extent.

Student Questionnaire Analysis ~ II

⑥ Common specific characteristics of DET

Agree ~ uses sci knowl, transfer of knowl, not all tech knowl written, uses maths concepts, solves problems, learn through making, balance thinking & doing, deep & wide thinking, reflect what is important, co-operate, collaborate, +ve impact on society, integrity, quality products, comms skills, towards self motivated learner, transferable skills, autonomy, linear simple → complex, troubleshoot, sensible about things not to change, summarise effectively informed comparisons,

Strongly Agree ~ creative ideas, guard earth's resources(*), skills good for a job(*)

Disagree ~ make money in DET(*)

Variations ~ function & aesthetics, 'Rote' learning, always purposeful, criticisms, needs of others, compromises, -ve impact on society, prejudices, values important, cope in changing world, honesty, independant thinkers, predict patterns/sequences.

Rurals ~ Suburbia differences ~ Prejudices (NV|D|NV vs SA|NV|NV|A|NV|A
+ve impact on soc (NV|A|NV vs NV|NV|SA|SA|NV|SA|A)
-ve impact on soc (D|SD|D vs A|D|SD|NV|NV|A)
values important (NV|D|NV vs NV|SD|D|A|D|NV)

Student Questionnaire Analysis ~ III

7 DET Knowl is:

No strong view ~ mainly facts, descriptive.

Agree ~ prescriptive (improvement), tranferable.

Wide variety ~ tacit (only by doing)

Ruralis - Suburbia differences ~ none discernable.

8 DET Processes about:

Agree ~ Produce things, maintain & use things.

Strongly agree ~ Creativity & inventiveness.

Ruralis - Suburbia differences ~ transform things ~ Ruralis agree but Suburbia disagree (slight variation).

9 Accurate assessment of DET ~ 'good'

Ruralis	Suburbia
Teacher Obs.	Writing Assignment.
Designing Systems.	Illustrating / Sketching.
Researching.	Teacher Observation
Tech Drwg.	Tech Drawing.
	Constructing Models.

Observation ~ only TD common to both. Teach Obs clear in Ruralis. Written test clear in suburbia.

Student Questionnaire Analysis - IV

(10) Tech Lit (observe, discuss, write DFT).

Ruralis	Suburbia
Citizenship	Articulate Tech Vocab
Informed Decisions	Ma/Sc Concepts
Articulate Tech Vocab	Think Logically
Think logically	Citizenship
Ma/Sci Concepts	Informed Decisions
Use network comms	Read/Write Tech Mats
Read/Write Tech Mats	Use network comms.

Closest correlations - unimportance of - use network comm
- read/write tech mats
- mid importance - think logically

Furthest differences - Citizenship, informed decisions, articulate tech vocab, Ma/Sc concept

Observations - Citizenship 1/7 Ruralis, 4/7 Suburbia.

(11) Tech Capability (able to do)

100% - Probs need solutions, Alternative Solutions, Various perspectives,
89% - Apply knowl to resources/problems, understand tech systems work,
67% - Assess benefits/risks,
44% - Learn tools in contexts, Respond to ethical moral di
56% - Tech nature in changing world.

Ruralis - Suburbia differences - Constrints/resources - R-67% - S 0%
Value Judgments - R 67% - S 0

Student Questionnaire Analysis – V

(12) Progression

(100%) Strong VI form – Divergent, Own Initiative, Find Probs to Sol

Good VI form – Teacher Source of Knowl, Teacher as consult

Some VI form – Given Probs to solve, Teacher equal partn
Convergent, Teacher as mentor

No VI form – Rely on teacher

Strong Y7 – Rely on teacher,

Good Y7 – Teacher source of knowl, Given Probs to Solv

Some Y7 – Teacher as consultant, Teacher as mentor

No Y7 – Divergent, Teacher equal partner,
Own Initiative

Ruralis – Suburbia differences – Y7 – Convergence (R 33% – S 66
– Teacher Mentor (R 100% – S 3
– Teacher consultant (R 17% – S 66

– Y12 – Convergent (R 84% – S 33
– Teach mentor (R 17% – S 66
– Given Probs Solve (R 67% – S 33

(13) Local Govt important?

Mainly No – Suburbia 1/3 Yes – Geog · Ruralis 1/6 Yes –
Entrance Hall.

Student Questionnaire Analysis ~ VI

(14) Projects / Materials

Similar experiences

Ruralis - Suburbia difference ~ Stronger design in Ruralis but more electronics in Suburbia.

(15) Community

Some ~ Ruralis ~ Entr Hall × 2, Int Des Pro × 1.
~ Suburbia Toys × 2, Paper Weight, Lamp, Timer.

(16) Others' Shoes ~ Poor Question from KA.

Only 1 response 1/12 ~ Suburbia Cupbd Alarm.

Appendix 5.2

Staff Questionnaire Responses

May 1999

Staff Questionnaire Analysis

1st May 1999

* 100% Questionnaire Return

* 75% Male 25% Female

* Thrust on 'Hard Tech'.

Staff Questionnaire Analysis

① **Specialisms** Both schools ~ Resistant Matls
Only Suburbia - Electronics / Contr
Only Ruralis ~ Textiles.

② **How long in present school?** ~ Ruralis ~ 2 × 5–10 yrs
Suburbia ~ 2 × 3–5 yrs

③ **Types of School** ~ Suburbia Staff ~ Only Suburba
Ruralis Staff ~ All 3 for both

④

	Ruralis	Suburbia	Variance
a) That vs How	5·625	4·75	–·875
b) Arts vs Sciences	4·0	5·25	+1·25
c) 'Learn' vs 'Use'	6·625	5·25	–1·375
d) Atomise vs Holism	6·00	6·25	+·25
e) Determin vs Emancip	6·75	5·375	–1·375
f) Stability vs Change	7·125	6·25.	–·875

General consensus on 'That' vs 'How', 'Atomise' vs 'Holism' 'Stability' vs 'Change'. Ruralis staff regarded DET as freedom seeking, also Suburbia, but to less of an extent. Ruralis staff tend towards 'use' knowledge as do Suburbia to a lesser extent. Ruralis associate tech with change, as do Suburbia to a lesser extent. Suburbia see DET as Scientifically inclined Ruralis see it as Art/Sci balance. Both view DET Holistically.

Staff Questionnaire Analysis ~ II

⑤ Common specific characteristics of D&T

Agree ~ uses sci knowl, transfer of knowl, not all D&T knowl written, uses Maths concepts, solve problem balance thinking & doing, deep & wide thinking, co-operate, collaborate, needs of others, compromises, prejudices, +ve impact on society values important, cope in changing world, honesty, integrity, guard earth's resources, quality products, comms skills, independent thinkers, toward self motivation, autonomy, skills good for a job, troubleshoot, sensible about things to change, predict patterns/sequence summarise effectively, informed comparisons.

Strongly Agree ~ Transferable skills, Guard earth's resources, solve problems.

Disagree ~ 'Rote' learning, make money in D&T.

Variations ~ creative ideas, learn through making, always purposeful, criticisms, linear process → simple to complex, negative impact on society.

Rurals Suburb

Rurals - Suburbia differences ~ Must involve making (D/D vs SA/SA)

Staff Questionnaire Analysis ~ III

⑥ DET Knowl is:

No strong view ~ descriptive

Agree ~ transferable, prescriptive (improvement)

Wide variety ~ mainly facts, tacit (only by doing)

Rurals - Suburbia differences ~ none discernable.

⑦ DET Processes about:

Agree ~ Control things, Produce things.

Strongly Agree ~ Creativity & inventiveness, transform thing

Rurals - Suburbia differences ~ Maintain & Use Things.

⑧ Intelligences Relevant to DET.

Agree ~ Linguistic, Logical/Mathematical, Spatial, Intraperso

No Strong View ~ Interpersonal,

Rurals - Suburbia differences ~ Bodily (kinaesthetic)
Rurals agree, Suburbia less sure.

Staff Questionnaire Analysis ~ IV

⑨ Accurate ~~of~~ assessment of DET ~ good.

Ruralis	Suburbia.
Teacher Obs	Teacher Obs
Illustr Sketch	Constr Models
Self Assess ← Constr. Models	Research
Prototype	Design Systems
Written Test.	Prototype
	Written Tests

⑩ Approaches to Assessment.

Agree - Reflective, Understanding

Strongly Agree ~ Evaluative, Continuous.

⑪ Tech Lit (observe. discuss. write DET).

Ruralis	Suburbia
Tech Vocabulary	Informed Decisions
Logical Sequential	Logical / Sequential
Comms Network	Citizenship
Informed Decisions	Ma / Sci Concepts
Citizenship	Comms Network
Ma / Sci Concepts	Tech Vocab
Read / Write	Read / Write

Closest correlations ~ important ~ Logical / Sequential
low importance ~ Read / Write

Furthest differences ~ Tech vocab, informed decisions, citizenship, comms network.

Observations ~ Tech vocab ~ ruralis 1/7, suburbia 6/7.

Staf Questionnaire Analysis ~ V

⑫ Tech Capability (able to do)

100% ~ Probs need solutions, alt ideas, knowl to resource problems, constraints / resources, various perspectives, learn tools in contexts (new), tech nature in changing world, tech systems work, assess benefits & risks, respond to ethical moral dilemmas (dimensions).

75% ~ Value judgments.

RESULTS
of

Staff Questionnaire on 'A' Level Design & Technology

The aim of this questionnaire was to find out opinions and views on some important issues concerning the teaching and learning of design and technology.

My research is partly to do with looking at how the local community and environment affects the work done in design and technology lessons. I am visiting schools in both suburban and rural contexts. I am interested in this area of study as I was born in an urban setting, grew up in a rural community and now teach in the suburbs of a city.

All of the 'A' Level Design & Technology syllabuses mention *capability* as something they aim to develop in students. The National Curriculum in Design & Technology, done at GCSE level also aimed to develop this. As a follow up to you completing this questionnaire I intend to discuss and explore what 'capability' might mean in some detail.

The questionnaire had a total of 15 questions, organised into 8 sections:

Section 1 - Background information	Questions 1-3
Section 2 - Characteristics of D&T	Questions 4-5
Section 3 - Thinking, Knowledge & Processes used in D&T	Questions 6-8
Section 4 - Assessment	Question 9-10
Section 5 - Capability	Questions 11-12
Section 6- School in general	Question 13
Section 7 - School specific details	Questions 14-16

Total confidentiality and anonymity is a condition of me being able to conduct the research. Participants have been be coded, known only to myself, so that individuals cannot be identified when reading the findings of my research. The same approach applies to the identity of the school. Each participant (student and teacher) along with the Head Teacher will view the findings and written comments prior to publication, retaining the right to edit or remove any references should they consider them to be inappropriate or enable the identity of the school to be revealed.

Keith Atkinson Nottingham Trent University May 1999

Staff Questionnaire

Section 1 - BACKGROUND INFORMATION

1. What combination of material specialisms do you offer within D&T?

(H)	TC	F	Graphics, Resistant Materials, Textiles (KS3 only)
(H)	SJ	M	Resistant Materials, Textiles, Food, Graphic Products
(C)	WG	M	Resistant Materials, Electronics, Graphics, IT & Control
(C)	IB	M	Metals, Plastics, Woods & Electronics

2. Have long have you been at your present school ?

0-2 years			
3-5 years	WG	IB	
5-10 years	TC	SJ	
over 10 years			

3. Which of the following types of school have you worked in?

Urban	TC	SA (TP only)		
Rural	TC	SA		
Suburban	TC	SA (TP only)	WG	IB

Section 2 - CHARACTERISTICS OF Design & Technology

People appear to have strong views about technology.

4. Technology to me is:

(please place a cross somewhere on each scale line to represent where your current views tend towards. The further from the centre, the more you agree with the phrase at the left or right hand end)

IB
TC WG SJ

Knowing 'that' ⟷ Knowing 'how'

SJ
TC IB WG

Pure Arts ⟷ Pure Sciences

IB WG TC SJ

'Learning' Knowledge ⟷ 'Using' Knowledge

IB
SJ
TC WG

Atomised ⟷ Holistic

SJ
WG IB TC

Deterministic (Inevitable) ⟷ Emancipatory (Freedom seeking)

SJ
IB WG TC

Stability ⟷ Change

5. Specific Characteristics of D&T

What is your view on each of the following statements about D&T?

(please tick the column that most closely reflects your view of each specific statement.)

		Strongly Agree	Agree	No Strong View	Disagree	Strongly Disagree
a	Uses Scientific Knowledge	TC	SJ WG IB	[ ]	[ ]	[ ]
b	Allows the transfer of knowledge to new situations	TC	SJ WG IB	[ ]	[ ]	[ ]
c	Not all D&T knowledge can be written down	SJ IB	TC WG	[ ]	[ ]	[ ]
d	Applies mathematical concepts	[ ]	TC SJ WG IB	[ ]	[ ]	[ ]
e	Knowledge has to be learnt by 'rote'	[ ]	[ ]	SJ	WG IB	TC

		Strongly Agree	Agree	No Strong View	Disagree	Strongly Disagree
f	Knowledge is used to solve problems	TC SJ IB	[ ]	WG	[ ]	[ ]
g	Being creative with ideas	TC SJ IB	[ ]	[ ]	WG	[ ]
h	Learning through making	TC SJ	IB	[ ]	WG	[ ]
i	Is about balancing Function with Aesthetics	TC SJ	WG IB	[ ]	[ ]	[ ]
j	<u>Must</u> involve making	TC SJ	[ ]	[ ]	WG IB	[ ]
k	Always a balance between 'thinking' and 'doing'	TC	SJ WG	IB	[ ]	[ ]

		Strongly Agree	Agree	No Strong View	Disagree	Strongly Disagree
l	Thinking thoughtfully and carefully (deeply/widely)	TC	SJ IB	WG	[ ]	[ ]
m	Is <u>always</u> purposeful	[ ]	TC IB	SJ	WG	[ ]
n	Requires reflection on what is important	[ ]	TC SJ WG IB	[ ]	[ ]	[ ]
•	Is about giving and taking all forms of criticism	SJ	TC IB	[ ]	WG	[ ]
p	Co-operating with others	[ ]	TC IB	SJ WG	[ ]	[ ]
q	Collaborating with others	[ ]	TC IB	SJ WG	[ ]	[ ]

		Strongly Agree	Agree	No Strong View	Disagree	Strongly Disagree
r	Considering the needs of others	SJ IB	TC WG	[ ]	[ ]	[ ]
s	Working towards compromises	SJ	TC WG IB	[ ]	[ ]	[ ]
t	Overcoming prejudices	SJ WG	TC IB	[ ]	[ ]	[ ]
u	Is about making a positive impact on society	TC SJ	WG IB	[ ]	[ ]	[ ]
v	Often has a negative impact on society	SJ	WG	[ ]	IB	TC
w	Beliefs and values are important when doing D&T	WG	TC SJ IB	[ ]	[ ]	[ ]

		Strongly Agree	Agree	No Strong View	Disagree	Strongly Disagree
x	Helps teach people to cope in a changing world	WG	TC SJ IB	[ ]	[ ]	[ ]
y	Honesty is important	[ ]	SJ WG IB	TC	[ ]	[ ]
z	Integrity is important	[ ]	TC SJ WG IB	[ ]	[ ]	[ ]
aa	Concerns guarding the earth's resources	TC SJ WG	IB	[ ]	[ ]	[ ]
bb	Developing quality products that work	SJ WG	TC IB	[ ]	[ ]	[ ]
cc	Developing a wide range of communication skills	TC	SJ WG IB	[ ]	[ ]	[ ]

		Strongly Agree	Agree	No Strong View	Disagree	Strongly Disagree
dd	Teaches people to be independent thinkers	TC	SJ WG IB	[ ]	[ ]	[ ]
ee	Gradually changes dependent learners into self-motivated individuals	SJ	TC WG IB	[ ]	[ ]	[ ]
ff	Skills gained are transferable	TC SJ WG IB	[ ]	[ ]	[ ]	[ ]
gg	Develops autonomy	SJ WG	TC IB	[ ]	[ ]	[ ]
hh	Is a 'linear process' that moves from the 'simple' to the 'complex'	[ ]	TC IB	[ ]	SJ WG	[ ]
ii	Making money through D&T activities is important	[ ]	[ ]	IB	SJ WG	TC

		Strongly Agree	Agree	No Strong View	Disagree	Strongly Disagree
jj	Skills gained are useful when looking for a job	TC SJ	WG IB	[ ]	[ ]	[ ]
kk	Being able to 'troubleshoot' problems	TC SJ	WG IB	[ ]	[ ]	[ ]
ll	Teaches us to be sensible about the things that cannot be changed	[ ]	SJ WG IB	TC	[ ]	[ ]
mm	Predicting patterns and sequences is important	[ ]	SJ WG	TC IB	[ ]	[ ]
nn	Teaches us to summarise things effectively	[ ]	TC SJ WG IB	[ ]	[ ]	[ ]
oo	Allows us to make informed comparisons	SJ WG	TC IB	[ ]	[ ]	[ ]

Section 3 - THINKING, KNOWLEDGE & PROCESSES USED IN D &T

6. D&T Knowledge is:

*(please give each comment a score from 1 to 5,
1 if you agree strongly, 5 if you disagree strongly)*

		Ruralis Sch		Suburban	
		TC	SJ	WG	IB
a	Transferable	1	1	1	1
b	Mainly facts	5	2	4	4
c	Descriptive	2	3	4	3
d	Tacit ~ (developed only by doing)	5	2	4	4
e	Prescriptive ~ (about the process of improvement)	2	2	2	3

7. D&T Processes are about:

*(please give each comment a score from 1 to 5,
1 if you agree strongly, 5 if you disagree strongly)*

		Ruralis Sch		Suburbia	
		TC	SJ	WG	IB
a	Creativity and Inventiveness	1	1	1	1
b	Transforming things	1	1	2	2
c	Controlling things	2	2	2	2
d	Producing things	2	1	3	1
e	Maintaining & Using things	2	1	3	3

8. The following 'intelligencies' are relevant to D&T:

(please give each comment a score from 1 to 5, 1 if you agree strongly, 5 if you disagree strongly)

		Ruralis Sch		Suburbia	
		TC	SJ	WG	IB
a	Linguistic ~ read write and communicate	1	1	1	2
b	Logical/Mathematical ~ identify and solve problems	1	1	2	1
c	Spatial ~ express ideas (design, draw, prototype)	1	1	2	1
d	Bodily ~ kinaesthetic (construct, manipulate environments and devices)	1	2	3	1
e	Interpersonal ~ organise and manage group responses & problem situations	2	3	3	2
f	Intrapersonal ~ set personal goals and work independently	1	2	2	2

Section 4 - ASSESSMENT

9. Assessment Procedures in Design & Technology.

Which of the following are the most accurate ways of assessing how 'good' someone is at D&T?

(please number your TOP 5 ONLY number 1 being the most important, number 2 being the second most important etc.)

		Ruralis Sch		Suburbia	
		TC	SJ	WG	IB
a	Teacher observation	1	1	1	2
b	Written test	5			5
c	Constructing models	2		3	1
d	Prototyping		2	4	
e	Designing systems			2	
f	Illustrating/Sketching	3	3		3
g	Presenting				
h	Writing assignments				
i	Researching			5	4
j	Class participation				
k	Technical Drawing				
l	Interviewing		4		
m	Self-assessment	4	5		
n	Peer group assessment				

10. The philosophies underpinning student assessment are often diverse.

As a practising teacher, how would you rate each of these approaches?

(please give each comment a score from 1 to 5,
1 if you agree strongly, 5 if you disagree strongly)

		Ruralis Sch TC	SJ	Suburbia WG	IB
a	Evaluative ~ relative to outcomes and performance	1	1	1	2
b	Reflective ~ covering the activity based nature of the subject	2	2	2	3
c	Understanding ~ observing the strategic or technological changes	3	2	2	2
d	Continuous ~ 'on the hoof', holistic, mental constructions	2	1	2	2

Section 5 - CAPABILITY

11. Technological Literacy

Please identify which you think are most important when observing, discussing or writing about D&T.

(please place the following in rank order from 1 to 7,
1 being the most important, 2 being the second most important etc.)

		Ruralis Sch TC	SJ	Suburbia WG	IB
a	Citizenship ~ people reflecting on the needs of society	6	5	3	2
b	Effectively articulating technological vocabulary and concepts	1	2	6	6
c	Applying mathematical and scientific concepts	2	7	4	5
d	People reading and writing technological materials (essays, etc.)	7	6	7	7
e	Using networks of communications both efficiently and effectively	3	3	5	4
f	Thinking logically and being able to sequentially programme	4	1	1	3
g	Making informed decisions about technological issues	5	4	2	1

12. Technological Capability

The following statements describe what technologically capable people are able to do.

(please tick all statements that you think are true)

		Ruralis		Suburbia	
		TC	SJ	WG	IB
a	Recognise that problems need solutions				
b	Develop and evaluate alternative ideas and solutions				
c	Select, optimise and apply knowledge and resources to practical problems				
d	Work with imposed constraints and limited resources				
e	Assess effectiveness of technological solutions from various perspectives				
f	Make value judgements regarding actions whilst solving problems	x			
g	Feel comfortable learning about tools/systems in home/leisure/work contexts				
h	Understand the nature and role of technology in a rapidly changing world				
i	Understand how technological systems are designed, used and controlled				
j	Able to quantify benefits and assess the risks associated with technology				
k	Able to respond rationally to ethical or moral dilemmas caused by technology				

Section 6 - REGARDING SCHOOL IN GENERAL

Q13. Are there any instances you can think of where children are encouraged to consider the local environment when doing D&T?

Yes [ ]
No [ ]

If yes, please give as much detail as possible Ruralis Sc.h ~ TC and SJ highlighted a project to improve wall hangings for the school's entrance hall. The project required students to think about their local environment and to reflect their perceptions in their designs. In Suburban Sch. WG highlighted work done through an energy project, focusing specifically upon conservation.

Section 7 - DESIGN & TECHNOLOGY - SCHOOL SPECIFIC DETAILS

14. Please list examples of the types of project you undertake with students in D&T lessons.

(in the brackets under each line please give details of the main materials used in each project, e.g. food, wood, electronics, metal, textiles, plastics, etc.)

RURALIS SCH

Y7 - Puzzle - Wood/electronics

Y7 - Door Hanger - Plastics

Y7 - Easter Treats - Plastics/Food

Y7 - Key Tag - Metals

Y8 - Sensor - Electronics/Plastics

Y8 - Mechanical Toy - Wood

Y8 - Structures - Wood

Y8 - Other Cultures - Food

Y8 - CAD/CAM - Plastics

Y8 - Wall Hanging - Textiles

Y9 - Timer - Electronics/Plastics/Wood

Y9 - Drawing Machine - Hydraulics

Y10 - Clock -Plastics/Wood

Y10 - Jewellery - Metal/Various

Y10 - Major Projects - Graphics

SUBURBAN SCH

Y7 - Celebration Utensil - Plastics

Y7 - Bottle Opener - Acrylic/Metal & CAD/CAM

Y7 - Traffic Lights - Computer Control

Y8 - Mechanical Toy - Wood

Y8 - Steady Hand Game - Wood/Electronics

Y8 - Structures - Wood

Y8 - Spreadsheets - I.T.

Y9 - Digital Alarm - Plastics/Electronics

Y9 - Environmental Sensor - Electronics/Plastics

Y10 - GCSE Core Theory - Electronics

Y10 - Major Project - Portfolio research/Graphics

Y11 - Major Projects - Wood/Metal/Plastics	Y11 - Major Projects - W/M/P/Txt/Elecs
Y12 - Pattern Design - Graphics	Y12 - Electronic Product - W/M/P/Elecs
Y12 - Entrance Hall - Wood/Glass/Plastics	Y12 - Community Project - Wood
Y12 - Toy - CAD/CAM	
Y13 - Major Project - Wd/Met/Plas/Text.	Y13 - Major Project - W/M/P/Txt

15. Which, if any of the projects you have highlighted above, involve thinking about your community and designing and/or making something to be used locally or by people you know?

Ruralis Sch ~ TC felt that the GCSE Major Project (Y10 & 11), Entrance Hall Project (Y12) and 'A' Level Major Project (Y13) all required students to design/make something to be used at a local level.

~ SJ identified the clock project (Y10), Sensor Project (Y8), Puzzle Project (Y7) and Timer Project (Y9) were undertaken with local use in mind.

Suburban Sch ~ WG indicated strongly that his work across all projects are envisioned with the wider community in mind. This was due to the school's ethos and values.

~ IB identified the Y12 'A' Level Minor Projects as a vehicle for wider community perspectives to be considered with complexity and conviction.

16. Please give any details of projects where you encourage students to 'put themselves in other peoples shoes' when designing and making technological artefacts.

Ruralis Sch ~ TC identified the Y7 Chocolate project as a vehicle for students to consider retailer, consumer and manufacture perspectives. SJ identified the Y8 Sensor project as a means for students to consider the perspectives of blind, deaf and other disadvantaged groups or individuals.

Suburban Sch ~ Both WG and IB indicated the importance of considering others' perspectives in the GCSE Major project (Y10 & 11). They highlighted the emphasis placed on genuinely considering others in some depth and detail.

Keith Atkinson May 1999

Appendix 5.3

2D Array of Responses

~ Suburbia & Ruralis Students ~

Suburbia vs Rural's Sch Analysis ~ STUDENTS

	①	②	③			① A	② B	③ C	④ D	⑧ E	⑥ F	7 G
	CB	FE	JI			ND	CG	BC	MH	WH	AJM	
① 'A' Levels	Ar En DT	Ma Ph Te	To So			DT Gg G.Sr.	Me So Des	Ar, PE, GS, DT	En DT Ar G.Sr	Ar Des	Des PE.	
				Ave								Ave
② Main Reasons? Some Variat.	• Grade • Enjoy • Careers	• Uni Ap • Enjoy • MRS	• Enjoy • Teacher • Reputat.			• Enjoy • Grade • Career	• Enjoy • Grade • Skills	Uni Ap Careers Enjoy	• Enjoy • Skills • RecTea	• Enjoy Grade Skills	Enjoy • Grade Teacher.	
③ Intended Career Yet?	×	RAF Engineer	×			Teach	Designer (Uni)	Prod Des.	Found Course ArD Gr Des.	×	×	
④ Since 47.	Yes	Yes	Yes			Yes	No Urban	Yes	Yes	Yes	Yes	
⑤ i) That vs How (scale 1 2 3 4 5 6 7)	5	4	4.4	4.5	✓	4	4	5	4	6	5	4.[illegible]
ii) Arts vs Sciences	4	6	3.4	4.5	✓	4	5	6	4	3	4	4.[illegible]
iii) 'Learn' vs 'Use'	3	5	2.6	3.5	*	4	4	6	4	4	5	4.[illegible]
iv) Atomised vs Holistic	4	6	2.4	4.1	✓	4	4	4	4	4	5	4.[illegible]
v) Deterministic vs Emancipatory	4	4	5.4	4.5	✓	6	6	5	6	4-6	4	5.[illegible]
vi) Stability vs Change.	4	7	5.4	5.5	*	5	4	2	6	4	6	4.[illegible]
⑥ a) Uses Sci Knowl	A	A	A		×	NV	A	NV	A	A	A	
b) Transfer of Knowl	A	A	A		×	A	A	A	A	NV	A	
c) Not all DT Knowl Written	NV	SA	NV		×	NV	A	SA	A	A	A	
d) Maths Concepts	A	A	A		×	NV	A	NV	A	A	A	
e) 'Rote'	NV	D	A		×	NV	NV	NV	NV	NV	A	
f) Solve Problems	A	A	SA		×	A	A	SA	SA	A	A	
g) Creative Ideas	SA	A	SA		×	SA	SA	SA	SA	SA	SA	
h) Learn through Making	A	A	SA		×	SA	NV	A	SA	A	SA	
i) Function & Aesthetics	NV	D	A			NV	NV	SA	SA	A	SA	
j) Must Involve Making	D	D	SA	Wide Flock		SD	D	SD	SA	NV	NV	
k) Balance Thinking / Doing	NV	NV	A		×	NV	A	NV	A	A	A	
l) Deep / Wide Thinking	A	A	A		×	A	A	SA	SA	NV	SA	
m) Always Purposeful.	A	D	A	Flock		SD	SD	A	A	A	NV	

SA = Strongly Agree A = Agree NV = No view D = Disagree SD = Strongly Disagree.

Ruralis Sch Analysis ~ 2.

(2)

			1 CB	2 FE	3 JI		1 ND	2 CB	3 BC	4 MIH	5 WH	6 AJM
n	Reflect what is important.		NV	A	NV		NV	A	A	SA	NV	A
o	Criticisms		NV	A	A	Variat	SA	A	D	SA	NV	A
p	Co-operate		NV	A	SA		SA	SA	NV	SA	SA	A
q	Collaborate		NV	A	A		SA	SA	NV	SA	A	A
r	Needs of others		A	D	A	Variat	SA	SA	SA	SA	NV	A
s	Compromises		NV	D	SA	Variat	SA	NV	D	SA	NV	A
t	Prejudices	Differences	NV	D	NV ~~SA~~		SA	NV	NV	A	NV	A
u	+ve impact on society		NV	A	NV ~~SA~~		NV	NV	SA	SA	A	SA
v	-ve impact on society		D	SD	~~A~~ D	Wide Variat	A	D	SD	NV	NV	A
w	Values important		NV	D	NV ~~SA~~	Wide Variat	~~SA~~ NV	SD	D	A	D	NV
x	Cope in Changing World	Differences	A	D	~~A~~ D		NV	NV	NV	SA	NV	A
y	Honesty		NV	NV	A	Wide Variat	NV	SA	SD	NV	D	A
z	Integrity		NV	NV	A		NV	A	NV	A	NV	A
AA	Guard earth resources		SA	A	NA	Variat	~~NV~~ (D)	NV	SA	SA	NV	SA
BB	Quality products		SA	A	A		A	SA	SA	SA	A	SA
CC	Comms skills		NV	D	~~SA~~ A		SA	A	SA	SA	A	A
DD	Independent thinkers	Differences	NV	D	SA	Variat	SA	NV	SA	SA	A	A
EE	Toward self-motivated		NV	SA (All A's)	~~A~~ NV		A	A	SA	A	NV	A
FF	Transferable Skills		NV	SA	A		A	SA	SA	SA	A	A
GG	Autonomy		NV	A	~~NV~~ A		NV	A	SA	SA	NV	NV
HH	Linear - Simple → Complex.		NV	A	~~NV~~ SA		NV	A	A	NV	A	SA
II	Make money in DT.		D	D	D	Variat	~~NV~~ SD	A	D	D	A	A
JJ	Skills good for a job.		SA	D	~~NV~~ SA	Vary	A	SA	SA	SA	A	SA
KK	Troubleshoot		NV	A	~~D~~ A		NV	A	NV	SA	SA	SA
LL	Sensible about things not to change.		NV	A	A		NV	A	SA	SA	NV	SA
MM	Predict patterns/sequences		NV	D	~~A~~ NV	Vary	D	NV	D	SA	NV	SA
NN	Summarise effectively		A	A	A		A	NV	A	SA	NV	SA
OO	Informed comparisons.		NV.	A	A		A	NV.	A	SA	NV.	SA

Suburbia + Rivals Sch Analysis ~ 3. ~ Students

1 = agree strongly
5 = disagree strongly

⑦ D&T Knowl is:		CB ①	FE ②	JI ③		ND ①	CB ②	BC ③	MH ④	WH ⑤	AJM ⑥
a) Transferable	Broad Agree	3	1	2	2.0	3	2	1	1	3	1
b) Mainly Facts	No Strong Views.	2	4	3	3.0	4	3	4	5	3	3
c) Descriptive	Agree / No View.	2	4	2	2.67	2	3	2	3	3	2
d) Tacit (only by doing)	Wide Variety	4	2	5	3.67	5	5	1	1	2	2
e) Prescriptive (improvement).	Agree *	3	2	2	2.33	2	2	1	2	1	2

1 = agree strongly
5 = disagree strongly

⑧ D&T Processes about:		CB	FE	JI	ND	CB	BC	MH	WH	AJM
a) Creativity + Inventiveness	St Agree	1	1	1	3	2	1	1	1	1
b) Transform Things	Agree / No View.	3	4	3	3	2	2	3	2	2
c) Control Things	Wide Variety	3	4	2	3	2	5	1	3	3
d) Produce Things	Agree *	2	2	2	2	1	2	1	1	1
e) Maintain / Use Things	Agree *	3	1	2	2	2	1	2	2	1

⑨

Assessment		CB	FE	JI		ND	CB	BC	MH	WH	AJM
Top	① Written	Written Test	Written Test	Teacher Obs ×	Teach	Teacher Obs	Teacher Obs	Tech Obs	Teach Obs	Miss	Design Syn
2nd	② Teach Obs	Illust Sketch	Teacher Obs	Class Particip.	Des	Design Sys	Tech Drwg	Design Syndic	Present	Miss	Illus Sketch
3rd	③ Illustrate	Interview	Written Assign	Illust Sketch	Res	Constr Models	Illus/ Sketch	Research	Research	Miss	Present
4th	④ TD	Tech Drwg	Tech Drwg	Written Task	Illus	Written Test	Constr Models	Tech Drwg	Illus/ Sketch	Miss	Research
5th	⑤ Model	Constr Models	Constr Models	Self A'ment	TD	Tech Drwg	×	Constr Models	Prototy	Miss	Tech Drwg

⑩ Tech Lit.

			CB	FE	JI		ND	CB	BC	MH	WH	AJM
Most Important	① Art Voc Concepts	Articul Vocab Concepts	Ma/Sc Content	Articul Vocab & Concepts	~~Articul Vocab Concepts~~	① Cit	Citizen	Articul Voc Concepts	Citizen	Citizen	Miss	Citizen
2nd		Citizen	Articulate Vocab & Concepts	Ma & Sci Concepts	~~Ma/Sc Concepts~~	② Inf Dec	Logic Think	Citizen	Informed Decision	Networks	Miss	Informed Decision
3rd	② Ma/Sc	Read Write Maths	Logic Think	Logic Think	~~Informed Decisions~~	③ Art Vocab	Informed Decisions	Ma/Sc Concepts	Articul Vocab Concepts	Informed Decisions	Miss	Articul Voc & Concept
4th	③ Logic	Informed Decisions	Citizen	Citizen			Articulate Vocab Concepts	Read Write Maths	Articulate Voc & Concepts	Logic Think	Miss	Ma & Sc Concept
5th	④ Citizen ⑤ Inf Decis.	Networks	Read & Write Maths	Read & Write Maths	Read/write Maths	④ Log Think	Ma/Sc Concepts	Logic Think	Logic Think	Articul Voc & Concepts	Miss	Logic Think
6th	⑦ Net	Logic Think	Networks	Informed Decisions		⑥ Networks	Networks	Informed Decisions	Networks	Ma/Sc Concepts	Miss	Logic Think
7th	⑥ Read Write	Ma/Sc Concepts	Informed Decisions	Networks	⑤ Ma/Sc Con	⑦ Read Write	Read & Write Maths	Networks	Read & Write Maths	Read & Write Maths	Miss	Networks

Rivalis Sch Analysis ~ 4

11) Tech Capability (Tick True)			① CB	② FE	③ JI		① ND	② CB	③ BC	④ MHH	⑤ WH	⑥ A/M
a) Probs need Solutions	100%	100%	✓	✓	✓	100%	✓	✓	✓	✓	✓	✓
b) Alt Ideas	100%	100%	✓	✓	✓	100%	✓	✓	✓	✓	✓	✓
c) Know to resources/probs	89%	100%		✓	✓	83%		✓	✓	✓	✓	✓
d) constraints/resources *	44%	0%				67%		✓	✓	✓		✓
e) Various Perspectives	100%	100%	✓	✓	✓	100%	✓	✓	✓	✓	✓	✓
f) Value judgments *	44%	0%				67%	✓	✓		✓		✓
g) learn tools in contexts (new)	44%	33%			✓	50%				✓	✓	✓
h) tech nature in changing world	56%	33%			✓	67%		✓		✓	✓	✓
i) Tech systems work	89%	66%	✓	✓		100%	✓	✓	✓	✓	✓	✓
j) Access benefits risks	67%	100%	✓	✓	✓	50%				✓	✓	✓
k) Respond to ethical/moral dilemmas	44%	66%	✓	✓		33%				✓		✓

12 Progression

Y7 compare to Y12

				CB	FE	JI		ND	CB	BC	MHH	WH	A/M
a) Divergent	VI		(0%) 100%	VI	VI	VI	(0%) 100%	VI	VI	VI	VI	VI	VI
b) Own Initiative	VI		(0%) 100%	VI	VI	VI	(17%) 100%	VI	7 VI	VI	VI	VI	VI
c) Convergent Diff *	Some 7	Some VI	(66%) 33%	7	7	VI	(33%) 84%		7 VI	7 VI	VI	VI	VI
d) Rely on teacher	7		(100%) 0%	7	7	7	(100%) 0%	7	7	7	7	7	7
e) Teacher as 'mentor'	7	Some VI	(33%) 66%	VI	VI	7	(100%) 17%	7	7 VI	7	7	7	7
f) Teacher equal partner Diff *		Some VI	(0%) 33%			VI	(0%) 67%		VI	VI	VI		VI
g) Teacher as consultant Diff *	Some 7	More VI	(66%) 33%	7	7	VI	(17%) 100%	VI	VI	VI	VI	VI	7 VI
h) Teacher-source of knowl	More 7	More VI	(66%) 100%	7 VI	7 VI	VI	(67%) 83%	7	7 VI	7 VI	VI	VI	7 VI
i) Probs to solve (Given)	More 7	Some VI	(66%) 33%	7	7	VI	(83%) 67%	7 VI	7 VI	VI	7	7	7 VI
j) Probs to solve (Find)		All VI	(0%) 100%	VI	VI	VI	(17%) 100%	VI	7 VI	VI	VI	VI	VI

		CB	FE	JI	ND	CB	BC	MHH	WH	A/M
13 Local Envt?	Mainly No	No	Yes Geog	No	No	Yes~ Gat Hall	No	No	No	No

Ruvalis Sch Analysis ~5

(14) Projects / Matls.

Y10
Y10
Y11
Y12
Y12

Similar Experiences

More elecs at Suburbia but stronger design in Ruvalis.

(15) Community: Some

(16) Others Shows: Poor (or last Q).

	1 CB	2 FE	3 JI
(14) Projects / Matls	Alarm El Wo Fax Dish Food Mag Pro El/Pl Toy El Wo Rack Plast	Alarm El Wood Fax Food Food Fish Food El Wo/Pl Lamp W/Wo Paper Pa Plast.	Cnt Son El Pl Toast Timer El/Plas Mac Baby Walker Pl El Holder Plast Bike At El/Pl
(15) Community	Fire Eng (Kids)	Paper Weight + Lamp	Baby Walker Timer
(16) Others Shows	Miss	Miss	Cupbd Alarm. Parents.

	1 ND	2 CB	3 BC	4 MH	5 WH	6 AJM
(14) Projects / Matls	Clock Plast Contain Wood. Mag Pro Wood Ent Hall Multi Wall Paper	Olympic Card Miss Mag Pro Wood Ent Hall Wood Miss	Miss Contain Wood Mag Pro Plast. Ent Hall Wood. Miss	Miss Miss Miss Entr Hall Wood. Miss	Miss Miss Car Des Syrofo. Int Des Hood Paper Art Deco	Miss Contain Wood Mag Pro Wood Ent Hall Wood Paper Art De
(15) Community	Miss	Miss	Entr. Hall	Entr Hall	Int Des Pro	Miss
(16) Others Shows	Miss	Miss	Miss	Miss	Miss	Miss

Appendix 5.3

2D Array of Responses

~ Suburbia & Ruralis Staff ~

SUBURBIA VS RURALIS SCH ANALYSIS ~ STAFF

		① WG	② IB		③ SJ	④ TC	
①	SPECIALISMS	RM EL GR H	RM EL		RM Txt GrEd	GR RM Tx	
②	HOW LONG IN PRESENT SCHOOL	3-5	3-5		5-10	5-10	
③	TYPES OF SCHOOL	SU	SU		UR(TI) RU SUB(TI)	UR RU SUB	
④	That vs. How (1 2 3 4 5 6 7)	5.5	4	4.75	7.25	4	5.625
i)	Arts vs Sciences	5.5	5	5.25	4.0	4	4.0
ii)	'Learn' vs 'Use'	5.5	5	5.25	7.25	6	6.625
iii)	'Atomised' vs 'Holistic'	6.5	6	6.	6	6	6
v)	Deterministic vs Emancipatory	4.5	6.25	5.375	6.75	6.75	6.75
vi)	Stability vs Change.	6.5	6	6.25	7.25	7	7.125

⑤				WG	IB	SJ	TC
a)	Uses Scien Knowl	Agree	×	A	A	A	SA
b)	Transfer of Knowl.	Agree	×	A	A	A	SA
c)	Not all DT written	Agree	×	A	SA	SA	A
d)	Maths concepts	Agree	×	A	A	A	A
e)	'Rote'	Disagree	×	D	D	NV	SD
F)	Solve Probs	Agree	×	NV	SA	SA	SA
g)	Creative Ideas	WG Generally ¾		D	SA	SA	SA
h)	Learn through making	WG Generally ¾		D	A	SA	SA
i)	Function & Aesthetics	Ruralis SA Sub A		A	A	SA	SA
J)	Must involve making	* Difference	*	D	D	SA	SA
K)	Balance Thinking/Doing	Agree	×	A	NV	A	SA
l)	Deep/Wide thinking	Agree	×	NV	A	A	SA
M)	Always purposeful	WG Generally ¾		D	A	NV	A

SA = Strongly agree A = Agree NV = No view D = Disagree SD = Strongly Disagree

Suburbia & Ruralis Sch Analysis ~ 2 ~ STAFF.

(5)

				1 WG	2 IB	3 SJ	4 TC
n	Reflect on what is important	Unanimous		A	A	A	A
o	Criticisms	WG Variance 3/4	—	D	A	SA	A
p	Co-operate	Agree	X	NV	A	NV	A
q	Collaborate	Agree	X	NV	A	NV	A
r	Needs of others	Agree +	X	A	SA	SA	A
s	Compromises	Agree	X	A	A	SA	A
t	Prejudices	Agree	X	SA	A	SA	A
u	+ve impact on society	Agree	X	A	A	SA	SA
v	−ve impact on society	* Wide disagreement	*	A	D	SA	SD
w	Values important	Agree	X	SA	A	A	A
x	Cope in changing world	Agree	X	SA	A	A	A
y	Honesty	Agree	X	A	A	A	NV
z	Integrity	Agree	X	A	A	A	A
aa	Guard earths resources	Agree	X	SA	A	SA	SA
bb	Quality Prods	Agree	X	SA	A	SA	A
cc	Comms Skills	Agree	X	A	A	A	SA
dd	independent thinkers	Agree	X	A	A	A	SA
ee	Towards self-motivation	Agree	X	A	A	SA	A
ff	Tranferable Skills	Unanimous	X	SA	SA	SA	SA
gg	Autonomy	Agree	X	SA	A	SA	A
hh	Linear Simple → Complex	* Variance	—	D	A	D	A
ii	Make money in D&T	Disagree	X	D	NV	D	SD
jj	Skills good for a job	Agree	X	A	A	SA	SA
kk	Troubleshoot	Agree	X	A	A	SA	SA
ll	Sensible about things not to change	Agree	X	A	A	A	NV
mm	Predict patterns/ sequences	Agree	X	A	NV	A	NV
nn	Summarise effectively	Agree	X	A	A	A	A
oo.	Informed comparisons	Agree	X	SA	A	SA	A

Suburbia & Rivalis Sch Analysis ~ 3 - Staff.

(6) DET Knowl. is:

		(1) WG	(2) ID		(3) SA	(4) TC	
a) Transferable	Unanimously Agree	1	1	✓	1	1	✓
b) Mainly Facts	Generally Disagree	4	4	✓	2	5	*
c) Descriptive	— ?	4	3	-	3	2	-
d) Tacit (only by doing)	Generally Disagree	4	4	✓	2	5	*
e) Prescriptive (improvement)	Generally Agree	2	2	✓	2	2	✓

(7) DET Processes About:

		WG	ID		SA	TC
a) Creativity & Inventiveness	Unanimously Agree	1	1	✓	1	1
b) Transform Things	Generally Agree	2	2	✓	1	1
c) Control Things	Generally Agree	2	2	✓	2	2
d) Produce Things	? Agree	3	1	*	1	2
e) Maintain/Use Things	— ?	3	3	✓	1	2

(8) Intelligences Relevant to DET

	WG	ID	SA	TC
a) Linguistic	1	2	1	1
b) Logical/Mathematical	2	1	1	1
c) Spatial	2	1	1	1
d) Bodily	3	1	2	1
e) Interpersonal	3	2	3	2
F) Intrapersonal	2	2	2	1

(9) Assessment.

		WG	ID	SA	TC
Top	Teacher Obs.	Teach Obs	Constr Models	Teach. Obs	Teach Obs
2nd	Constr Models	Design Systems	Teacher Obs	Prototype	Constr Models
3rd	Illustr Sketch.	Constr Models	Illustr Sketch	Illustr Sketch	Illustrate Sketch
4th	Self Assess Written Test	Prototype	Research	Interview	Self Assess.
5th.	Researching. Prototype.	Research	Written Tests	Self Assess.	Written Test.

Suburbia & Ruralis Sch Analysis ~ 4 ~ Staff.

(10) Approaches to Assessment (Philosophy)

		① WG	② IB	③ SJ	④ TC
a) Evaluative	Agree	1	2 ✓	1	1 ✓
b) Reflective	Agree	2	3 ✓	2	2 ✓
c) Understanding	Agree	2	2 ✓	2	3 ✓
d) Continuous	Agree	2	2 ✓	1	2 ✓

(11) Tech Literacy

a) Most important	Logic Sequen	① Inf Dec	Logic Sequen	Inform Decis	Logic Sequen	Artic Vocab Concepts	① Vocab/Co
b) 2nd	Inform Decision	② Log Seq	Inform Decis	Citizen	Art Vocab Conc	Ma/Sc Concepts	② Log Seq
c) 3rd	Comms Netwk	③ Citizen	Citizen	Logic Sequen	Comms Net	Comms Network	③ Comms N
d) 4th	Citizen	④ Ma/Sc	Ma/Sc Con	Comms Net	Inform Decis	Logic Sequence	④ Inf Dec
e) 5th	Ma/Sc Con	⑤ Comms Net	Comms Net	Ma/Sc Con	Citizen	Inform Decision	⑤ Citizen
f) 6th	Tech Vocab.	⑥ Tech Voc	Tech Vocab	Tech Vocab	Read Write	Citizen	⑥ Ma/Sc
g) 7th	Read/Write	⑦ Read/Write	Read Write	Read Write	Ma/Sc Concept	Read + Write	⑦ Read/W

⇒

(12) Tech Capability

a) Probs need solutions.	✓	✓	✓	✓
b) All Ideas	✓	✓	✓	✓
c) Knowl to resources/problems.	✓	✓	✓	✓
d) Constraints / Resources	✓	✓	✓	✓
e) Various Perspectives	✓	✓	✓	✓
f) Value judgments	✓	✓	✓	⊗
g) Learn tools in contexts (new)	✓	✓	✓	✓
h) tech nature in changing world	✓	✓	✓	✓
i) Tech systems work	✓	✓	✓	✓
j) Assess benefits & risks	✓	✓	✓	✓
k Respond ethical / Moral dimensions.	✓	✓	✓	✓

Appendix 5.4

2D Array of Responses

~ All Together ~

COMPARISON OF STAFF & STUDENT RESPONSES. Q5 ~ Students
Q4 ~ Staff.

SECTION 2 CHARACTERISTICS OF DET.

QUESTION Nº	DETAIL	AVE ALL STUD.	AVE ALL STAFF	VARIANCE	AVE ALL SUBUR.	AVE ALL RUR.	VARIANCE.
A	'Know That' vs Know 'How'	4·6	5·1875	All err to 'how' + ·5875 staff more than students.	4·625	5·1625	All err to 'how' but ·5375 rurals more than suburbia.
B	'Arts' vs 'Sciences'	4·4	4·625	All err to Sciences + ·224 staff slightly more than students	4·875 5·5	4·15	All err to Sciences ·725 suburbia more than rurals
C	'Learn' vs 'Use'	4·0	6·00	Students balance learn + use + 2·0 staff nearly to use.	4·375.	5·5625.	All err to use 1·1875 Rurals significant
D	'Atomised' vs 'Holistic'	~~5·625~~ ~~5·125~~ 6·125.		All err to holistic 1·475 + ~~·975~~ students slightly, staff significantly	5·175. ~~4·675~~	5·1 ~~4·6~~	All err slightly to holism ·075 No significant difference.
E	'Deterministic' vs 'Emancip'	4·9	6·0625	All err to emancip + 1·1625 students = 5 staff 6+	4·9375	6·025.	All err to Emancip 1·0875 Rurals more than suburbia.
F	'Stability' vs 'Change'	5·0	6·6875.	All significantly to change + 1·6875. staff more so.	5·875	5·8125	All strong to change – ·0625 no significant difference.
		More moderate/ balanced ~ less polemical Tends to neutrality on each ...					

Comparison of Staff and Student Responses ~ Staff Responses.

Variance.	Ave. all.	Ave Suburbia.	Ave. Ruralis.

Section 2 Students Q5, Staff Q4.

Ⓐ Knowing that' vs Knowing how' — 100% of all respondents from No view to knowing how.

Variance	Ave all	Ave Suburbia	Ave Ruralis.
-.515	5·1875.	4·75.	5·625.

Ⓑ Pure 'Arts' vs Pure 'Sciences' — All Ruralis - Balance. All Suburbia - Sciences.

+1.25	4·625.	5·25.	4·0.

Ⓒ 'Learning' Knowledge vs. 'Using' Knowledge.

-1.375	6·00.	5·25.	6·625.

Ⓓ Atomised vs Holistic.

+0.25	6.125. *~~5.125~~.	*6·25	*6·00

Ⓔ Deterministic vs Emancipatory

-1.375	6·0625.	5·375.	6·75

Ⓕ Stability vs Change.

-.875	6·6875.	6·25.	7·125.

Comparison of Staff & Student Responses

Q6 ~ Students
Q5 ~ Staff.

	Specific Characteristics	Suburb Students	Suburb Staff	Variance ?	Rural Students	Rural Staff	Variance ?	Overall Views
A	Uses Sci Knowl	A	A	x	A	A	x	All Agree
B	Transfer of Knowl	A	A	x	A	A	x	All Agree
C	Not all DT Knowl written	A	A	x	A	A	x	All Agree
D	Maths concepts	A	A	x	A	A	x	All Agree
E	'Rote'	—	D	?	NV	D	Disagree	? Disagree
F	Solve Problems	A	A	x	A	SA	x	All Agree
G	Creative Ideas	A	—	?	All SA	SA	x	Agree
H	Learn through making	A	—	?	A	SA	x	Agree
I	Functions/Aesthetics	—	A	?	A	SA	x	Agree
J	Must involve making	—	D	?	—	SA	?	—
K	Balance think/doing	A	A	x	A	SA	x	All Agree
L	Deep/Wide Thinking	A	A	x	A	A	x	All Agree
M	Always Purposeful	A	—	?	—	A	?	Agree
N	Reflect what important	A	A	x	A	A	x	All Agree
O	Criticisms	A	—	?	— / A	A	x	Agree
P	Co-operate	A	A	x	A	A	x	All Agree
Q	Collaborate	A	A	x	A	A	x	All Agree
R	Needs of others	—	A	?	A	A	x	Agree
S	Compromises	—	A	?	— / A	A	x	Agree
T	Prejudices	— D	A	Disagree	A	A	x	* — *
U	+ve impact on Society	All A	A	x	A	A	x	All Agree
V	-ve impact on Society	D	—	?	—	-	?	—
W	Values important	D	A	Disagree	—	A	?	—
X	Cope in changing world	—	A	?	A	A	x	Agree
Y	Honesty	A	A	X	—	A	?	Agree
Z	Integrity	A	A	x	A	A	x	All Agree
AA	Guard earth's resources	A	A	x	A	SA	x	All Agree
BB	Quality Products	A	A	x	A	A	x	All Agree
CC	Comms Skills	—	A	?	A	A	x	Agree
DD	Independent thinkers	—	A	?	A	A	x	Agree
EE	Toward self-motivation	A	A	x	A	A	x	All Agree
FF	Transferable Skills	A	SA	x	A	A	x	All Agree
GG	Autonomy	A	A	x	A	A	x	All Agree
HH	Linear Simple → Complex	A	—	?	A	—	?	—
II	Make Money in D&T	All D	D	x	—	D	?	Disagree
JJ	Skills good for jobs	A	A	x	A	SA	x	All Agree
KK	Trouble shoot	A	A	x	A	SA	x	All Agree
LL	Sensible / Change	A	A	x	A	A	x	All Agree
MM	Predict Patterns	D	A	Disagree	—	A	?	—
NN	Summarise Effectively	All A	A	x	A	A	x	All Agree
OO	Informed Comparisons	A	A	x	A	A	x	All Agree

COMPARISON OF STAFF & STUDENT RESPONSES.

D&T Knowledge is:

Q7 ~ Students.
Q6 ~ Staff.

	Suburb Students	Suburb Staff	Variance ?	Rural Students	Rural Staff	Variance ?	Overall Views.
a) Transferable:	2.0 A	1 SA	A ×	1.83 A	1 A	A ×	A
b) Mainly Facts:	3.0 NV	4 D	NV/D ✓	4 D	3.5 D	D ×	D.
c) Descriptive:	2.67 NV	3.5 D	NV/D ✓	2.5 NV	2.5 NV	NV ×	NV
d) Tacit (only doing):	3.67 D	4 D	D ×	2.67 NV	3.5 D	NV/D ✓	D
e) Prescriptive (imp.):	2.33 NV	2 A	NV/A ✓	1.67 A	2 A	A ×	A

Agree ~ Transferable, Prescriptive (improvement)
Disagree ~ Mainly Facts, Tacit (only doing)
No View ~ Descriptive.

D&T Processes are about:

Q8 ~ Students.
Q7 ~ Staff.

	Suburb Students	Suburb Staff	Variance ?	Rural Students	Rural Staff	Variance ?	Overall Views
a) Creativity/Inventiveness	1.0 SA	1.0 SA	SA ×	1.29 A	1.0 A	A ×	SA/A.
b) Transform Things	3.34 D	2.0 A	D/A ✓	2.34 A	1.0 A	A ×	—
c) Control Things	3.5 NV	2.0 A	NV/A ✓	2.83 NV	2.0 A	NV/A ✓?	NV/A
d) Produce Things	2.0 A	2.0 A	A ×	1.33 A	1.5 A	A ×	A
e) Maintain/Use Things	2.0 A	3.0 NV	A/NV ✓	1.67 A	1.5 A	A ×	A/NV

Agree ~ Creativity/Inventiveness, Produce Things.
No View/Agree ~ Control Things (Students All No View, Staff All Agree)
Agree ×3/No View ×1 ~ Maintain/Use Things (Agree ~ All Students + Rural Staff)
Wide Variance ~ Transform Things (Suburb Students ~ Disagree, Rural Agree
Staff ~ both Agree

COMPARISON OF STAFF & STUDENT RESPONSES.

Most accurate assessment procedures.

Q9 students.
Q9 Staff.

	Suburb Students	Suburb Staff	Variance ?	Rural Students	Rural Staff	Variance ?	Overall Views	
Top	Written 1	Teacher Obs 1.	Teacher Obs 1.5, 1	Teacher Obs 1	Teacher Obs, 1	Teacher Obs 1.9	Teacher Obs	Top
2nd	Teacher Obs 2	Construct Modelling 2	Modelling 3.5 2	Designing Systems 2	Illustrate Sketch 2	Illustrate 2 Sketch 3.0	Illustr Sketch	2nd
3rd	Illustrate 3	Research 3	Written 3	Researching 3	Self Assess 3	Design Systems 3	Research	3rd
4th	Tech Drawing 4	Design Systems 4	Research 4	Illustrating 4	Prototype 4	Self Assess 4	Modelling	4th
5th	Constr Modelling 5	Prototype 5	Illustrate 5	Tech Drawing 5.	Constr Modelling 5	Research 5	~~Design~~ Written	= 5th

Clear Top ~ Teacher Obs (almost unanimous)
(4 out of 4 Mentioned)

3 out of 4 Mentioned ~ Illustrate, Modelling, Researching.
2 out of 4 Mentioned ~ Tech Drwg, Prototyping,
1 out of 4 Mentioned ~ Written, Designing Systems, Self Assessmen

COMPARISON OF STAFF & STUDENT RESPONSES

Most Important Aspects of Technological Literacy

Q10 ~ Stude[nts]
Q11 ~ Staff

		Suburb Students	Suburb Staff	~~Variance~~ SUBURB ORDER	Rural Students	Rural Staff	Variance RURAL ORDER	Comments STUDENT ORDER	Comments STAFF ORDER
Top	1	Articulate Vocabulary	Informed Decisions	5 Think Logically	Citizenship	Articulate Vocabulary	4 Artic Vocab	4 Artic Vocab	4 Think Logically
2nd	2	Ma/Sc Concepts	Think Logically	6 Informed Decisions	Informed Decisions	Think Logically	6 Informed Decisions	5 Citizen	5 Informed Decisions
3rd	3	Think Logically	Citizenship	6 Citizen	Articulate Vocabulary	Network of Comms	6 Think Logically	7 Think Logic	7 Artic Vocab
4th	4	Citizenship	Ma/Sc Concepts	6 Ma/Sc Concepts	Think Logically	Informed Decisions	6 Citizen	7 Ma/Sc Concepts	8 Netwk Comms
5th	5	Informed Decisions	Network of Comms	7 Articulate Vocab	Ma/Sc Concepts	Citizenship	9 Netwk of Comms	7 Informed Decisions	8 Citizen
6th	6	Read/Write Materials	Articulate Vocabulary	12 Netwk Comms	Network of Comms	Ma/Sc Concepts	11 Ma/Sc Concepts	13 Netwk of Comms	10 Ma/Sc Concepts
7th	7	Network of Comms	Read/Write Materials	13 Read Write Mat's	Read/Write Materials	Read/Write Materials	14 Read/Wr Materials	13 Read/Wr Mat's	14 Read/W Mat's

		Suburb Students	Suburb Staff	Rural Students	Rural Staff	Totals.		
Citizenship	~	4	3	1	5	13	4	✓
Articulate Vocabulary	~	1	6	3	1	11	=1	✓
Ma/Sc Concepts	~	2	4	5	6	17	5	✓
Read/Write Materials	~	6	7	7	7	27	7	× Bttm
Network of Comms	~	7	5	6	3	21	6	✓
Think Logically	~	3	2	4	2	11	=1	× Top
Informed Decisions		5	1	2	4	12	3	✓

Top Articulate Vocabulary + Think Logically
2nd —
3rd Informed Decisions
4th Citizenship
5th Ma/Sc Concepts
6th Network of Communications
7th Read/Write Materials.

COMPARISON OF STAFF AND STUDENT RESPONSES.

TECHNOLOGICAL CAPABILITY.

Q12 ~ Students
Q12 ~ Staff

	SUBURBAN						RURAL										COMMENTRY.
	STUDENTS			STAFF		COMMENT	STUDENTS						STAFF		COMMENT %		
	CB	FE	JI	HG	IB		RD	CB	BC	MH	WH	AJM	SJ	TC			
a) Problems need solutions	✓	✓	✓	✓	✓	5	✓	✓	✓	✓	✓	✓	✓	✓	100		100%
b) Alternative Ideas	✓	✓	✓	✓	✓	5	✓	✓	✓	✓	✓	✓	✓	✓	100		100%
c) Knowl to resources/probs	✓	✓	✓	✓	✓	5	•	✓	✓	✓	✓	✓	✓	✓	92	1	Everyone apart from 1 rural student.
d) Constraints/Resources	•	•	•	✓	✓	2 *	•	✓	✓	✓	•	✓	✓	✓	62	5	All staff, No Suburban Students
e) Various Perspectives	✓	✓	✓	✓	✓	5	✓	✓	✓	✓	✓	✓	✓	✓	100		100%
f) Value Judgments	•	•	•	✓	✓	2 *	✓	✓	•	✓	•	✓	✓	•	54	6	Most * Mixed 3/4 Staff, No Suburban Students
g) Learn Tool in Contexts (new)	•	•	✓	✓	✓	3 ?	•	•	•	✓	✓	✓	✓	✓	62	5	All staff ~ 1/3 Suburban 3/6 Rural
h) Tech Nature in Chang World	•	•	✓	✓	✓	3 ?	•	✓	•	✓	✓	✓	✓	✓	69	4	Every staff ~ 1/3 Suburban, 4/6 Rural
i) Tech Systems Work	✓	✓	•	✓	✓	4	✓	✓	✓	✓	✓	✓	✓	✓	92	1	Everyone apart from 1 suburban student.
j) Assess Benefits/Risks	✓	✓	✓	✓	✓	5	•	•	•	✓	✓	✓	✓	✓	77	3	All staff + suburban students ~ 3/6 Rural
k) Respond Ethics/Morals	✓	✓	•	✓	✓	4	•	•	•	✓	•	✓	✓	✓	62	5	All staff ~ 2/3 Suburban 2/6 Rural

Appendix 5.5

Follow-up Responses to undeveloped questions

Ask Bill ~ Community Project

What I intend in
45 mins – 1 hr.

2 = Why this research project.

2 = Purpose of interview.

2 = What Q'aire was for.

10 = Responses of your group ~ Δ late data

5/10 = Comparison with all other students.

20/30 = Then amplify various points arising out of your specific responses and my specific analysis.

5. = Explain what I think tech capability is after 3yrs of doctoral study.

46/61

Mon 28th June 1999
Tue

RURAL'S SCHOOL

TAPE COUNTER

① Why the project

- LLL
- Capability
- Tower Hamlets
- Market Rasen
- TFAA (NASA) - Tech Literacy - Body of Knowledge
- QCA - Tech Capability - Process.

Tape counter

② Purpose of this interview

- Clarify some of the points made / overcome poorer worded questions.
- Triangulate the data ~ check / prove its not a fiddle.
- Explore any points of interest / unexpected resp

Tape Count ③ How arrived at Questionnaire design

- Literature review - 300+ articles / books / internet sites
- Read each, notes on each, think about each, develop categories then questions.
- Did trial it.

~~Rurals~~ Suburban School Responses

Tape Counter (4)

1. A Level Choices ~ ~~Arts~~ ~~Ar, En, DT~~ ~~RAF Engineer~~ Eclectic..

2. Main reason for choosing ~ Enjoy (Grade)

3. Career? ~ ~~Design, Teachers~~ RAF

* (4) Type of school ~ Rural % (B) C.B. Any differen

4.5	4.5	3.5	4.1	4.5	5.5
a) 4.7	b) 4.3	c) 4.5	d) 4.2	e) 5.3	f) 4.5.

5.

6. Common characteristics. ~ Refer to sheet.

7. D&T Knowl ~ Prescriptive (about improvement), transferable.

8. D&T Processes ~ Creativity + Inventiveness ~ Produce, use & maint

Illust / Sketch ~~Sketch~~ * (9) Accurate assessment of D&T ~ Written Assign Illustrate | Sk
~~Teacher Obs~~ ~~Designing Systems~~,
~~Researching Tech Drwg~~
Tech Drwg, Construct Mo

(10) Tech Literacy ~ ~~Organising, Informed Decision~~, (1) Tech Vocab,
~~Think Logically~~ (2) Ma/Sc Concepts ~~Network Reading~~
(3) Think Logically (4) Citizenship.

others Shapes * (11) Tech Capability ~ probs need solutions, Alternative solutio
Various Perspectives

(12) Progression ~ Y6 - VI Form ~ differences ~ Divergent, Own lin
Find problems to solv

/ Explore * Not given problems to solve but find own problems

(13) Local Envt important ~ ~~Entrance Hall (Musical)~~
~~Not a good question~~ ~~Bradford Food/Culture~~ ?
Geography

* What don't you like

TYPES OF PROJECT DONE

14 Similar Experiences ~ Strong ~~design~~ electronics emphasis

15 Community ~ ~~Entrance Hall, Interior Design~~ Fire Engine, Paper Wt Lamp, Baby Wa[...] Timer- Pro[...]

Explore

16 Other Shoes - ~~Bradford Interfaith~~ centre ?

~~Other Fatigues or Rubbish Question~~

Cupbd Alarm - Parents.

Tape Counter

5 Comparison with Suburbia

Brief commentary on differences.

** ALSO General Pointers for Interviews ~ I.

Characteristics, Specific Characteristics, DT Knowl, DT Processes, A'm[...]
Tech Lit Tech Vocab

Tape Counter

6 DISCUSSION

A Types of D&T Activities done

7) Given ? 8) Freer 9) Prep for GCSE. ?

Tape Counter

6 B Extent of Electronics

Tape Counter

6 E Suburban choice popular Ma, Ph, DT. ?

Tape Counter

6 D Ruralis 'use' knowledge Suburbia 'Learn'

Is this evidence of process being most importan

Tape Counter

Give examples of going to find knowledge as a result of design briefs or designing

Tape Counter 6 (E)

How does ~~DET~~ Help overcome Prejudice

Types of prejudice. (disability).

Tape Counter 6 (F)

Tech has the impact on society - why? | h

Are there any specific examples.

Radio active Isotopes?

Tape Counter 6 (G)

No agreement on -ve impact on society

Q6 W vs Q 12 f

Tape counter | Q6 - Specific Characteristics
6(H) | (H) Beliefs & Values - Ambiguity compared to Q12 f.

Eg Religious School 1st 2 commandments ~ Love God & Neighbour ~ Literally put others first?

Tape counter | Values in Processes of D&T

Tape counter | Values in Products of D&T

Tape counter | Values in Purposes of D&T

Appendix 5.6

Data Triangulation Prompt Sheets

General Pointers for interviews. ~ I

Characteristics of DKT ~ General.

- 'Know that' vs Know 'how' ~ Uniform tendency towards 'how' staff more than students rural more than suburbia.
- 'Arts' vs 'Sciences' ~ Uniform tendency towards science apart from rural staff ~ exact balance. Suburbia students more inclined to sciences than Ruralis.
- 'Learn' vs 'Use' ~ Students see a balance (suburban absolutely so Ruralis slightly toward 'use') whereas all staff see 'it' clearly as 'using' knowledge (Ruralis particularly so)
- 'Atomised' vs 'Holistic' ~ All err toward 'holistic' students only slightly. Staff significantly. Ruralis and Suburbia are equally swayed by 'holism'.
- 'Deterministic' vs 'Emancipatory' ~ All err toward emancipatory significantly staff more than students, Ruralis more than Suburbia.
- 'Stability' vs 'Change' ~ All significantly inclined toward change staff more than students. Ruralis and Suburbia equal.

General Pointers for Interviews ~ II

Specific Characteristics of D&T.

All agree ~ Uses scientific knowledge, involves the transfer of knowledge, not all D&T knowledge can be written down, uses Mathematical concepts, solves problem balances doing and thinking, involves deep and wide thinking, encourages reflection upon what is important promotes co-operation, encourages collaboration, has a positive impact on society, concerns integrity, questions 'Guardianship of Earth's Resources', it's about the production of quality products, works towards developing self-motivated learners, develops transferable skills, help develop autonomy, develops skills that are useful in jobs (employment), develops trouble shooting abilities, helps teach us to be sensible about things we cannot change, helps to encourage effective summary, allows for informed comparison.

All Disagree ~ knowledge has to be learnt by 'rote', making money through D&T is important.

Most agreed ~ creative ideas were important, learning was done through making, a balance between function and aesthetics is desirable D&T is always purposeful, is about giving and receiving criticism, is about considering the needs of others, about making compromises, addresses how to cope in a changing world, about honest addresses communication skills, helps develop independent thinkers

General Pointers for Interviews ~ III

Staff - Student Differences ~ • students think design is linear, moving from simple to complex. Staff have mixed v[iews].

- Staff think predicting patterns is important, students disagree (suburbia) or have very mixed views (rurals).
- Staff see values as important, students either disagree (suburbia) or have mixed views (rurals).
- Suburban students disagree that technology has a negative impact on society, there are mixed views on all other categories.
- Suburban students disagree that DET helps to overcome prejudice, all others agree.
- Rural staff strongly agree that DET must involve making, suburban staff disagree student views were mixed.

General Pointers for Interviews ~ IV

Design and Technological Knowledge

All agree ~ 'it is transferable and prescriptive (improvem

All disagree ~ 'it isn't mainly facts and 'it isn't necessarily tacit (only by doing).

No agreement ~ on whether knowledge is descriptive.

Design and Technology Processes

All agree ~ 'its about creativeness / inventiveness, producing things.

No view or agreement on ~ its about controlling things (staff - student difference) (students all have no view, staff all agree)

~ Maintaining / using things (suburb staff have no view, all others agree ~ unanimity in Ruralis).

Wide Variance ~ transforming things (suburbia students disagree, Ruralis students agree, All staff agree).

General Pointers for Interview ~ V

Most accurate assessment procedures

All mentioned ~ teacher observation clearly seen by all as 1st or 2nd choice.

3/4 mentioned ~ illustrate, modelling, researching.

2/4 mentioned ~ technical drawing, prototyping

1/4 mentioned ~ written, designing systems, self-assessment.

Most important aspects of 'Technological Literacy'.

=Top ~ Articulate vocabulary and Think logically.
2nd ~ –
3rd ~ Making informed decisions.
4th ~ Citizenship.
5th ~ Maths / Scientific concepts.
6th ~ Network of communications.

General Pointers for Interview ~ VI

Characteristics of 'Technological Capability'

100% ~ • Problems need solutions.
• Generation of alternative ideas.
• Considering various perspectives is important.
•

92% ~ • Apply knowledge to materials/resources/problems.
• Explain how technological systems work.
•

77% ~ • Assess benefits and risks.
•

69% ~ • Understand role of technology in changing wor
•

62% ~ • Working within constraints and resources.
• Learn new tools/processes in new contexts.
• Respond to ethical and moral dilemmas.
•

54% ~ • About value judgments.

Suburbia

Done Less RM than Ruralis • Discuss what D&T activities done - Resistant materials

• In both schools Ar, En, D&T strong option choice

• Only in suburbia Ma, Ph, D&T ? - Any reason (Option choices)

General Characteristics • Suburbia students tend to 'learn knowledge' (more Ma/Sc conce
- Ruralis students tend to 'use' knowledge (more 'design'

• Suburbia students view tech more as 'change' than ruralis (though rurals still view it as 'change').

Specific Characteristics • Rural students think generally D&T helps to overcome prejudice, suburbia generally disagree. explore this (Bradford centre - ~~we are~~ suburbia more multi-cultural)

• Stronger agreement that tech is about +ve impact on society, ~~as compared with~~ in ruralis than suburbia (still agree but less strong) - (some from both schools had no view).

• Suburbia disagree about -ve impact on society (ruralis range from SD to A with several NV) Why?

• Suburbia ambivalent or negative about values importance, views vary from ruralis (SD - D - NV - A) Explore values issue.

Suburbia

Technological Capability

- Differences - Work with constraints & limited resources
  Rurals 67% Suburbia 0%

  - Make value judgments regarding actions whilst o
    Rurals 67% Suburbia 0%

Ruralis

DET Knowledge

- No discernable difference
  - All agree - its transferable, prescriptive (improvement)
  - No strong view - mainly facts descriptive
  - Wide variety - tacit (only by doing).

DET Processes

- One difference - Transform things - Rural agree - Suburbia di
  - Strongly agree - creativity & inventiveness
  - Agree - produce things, maintain & use things.

Assessment.

- Ruralis see Teacher obs, Designing Systems & Researchi
  Suburbia see Written Test, Illustrating/Sketching & Teacher O
  - Only teacher obs and technical drawing common to

Technological Literacy

Ruralis	Suburbia
Citizenship	Articulate Tech Vocab
Informed Decision	Ma/Sc Concepts
Articulate Tech Vocab	Think Logically
Think logically	Citizenship
Ma/Sc Concepts	Informed Decision
Use network comms	Read/Write Tech Matls
Read/write tech matls	Use Network Comms

- Closest correlations - Unimportant - Netwk comms
  - Read/Write Tech Ma
  - Important - Think logically.

- Furthest differences - Citizenship, Informed Decisions, Articulate Tech Vocab, Ma/Sc Concep

Ruralis

Done Less Electronics than Suburbia.	• Discuss what D&T activities done ~ Electronics ~ extent.
	• In both schools Ar, En, D&T strong option choice.
	• Only in suburbia Ma, Ph, DT ? ~ Any reason (Emphasis on Electro
General Characteristics	• Ruralis students tend to 'use' knowledge (more design ? - Suburbia students tend to 'learn' knowledge (more Hofe conc
	• Ruralis students view tech ~~more~~ less as 'change' than Suburbia (although ~~suburbia~~ ruralis still view as 'change').
Specific Characteristics	• Rural students think generally D&T helps to overcome prejudice, suburbia generally disagree - explore this) (Bradford centre ~ suburbia more multi-cultural).
	• Stronger agreement that tech is about +ve impact on society in ruralis than suburbia (still agree but less strongly) - (some from both schools had no view).
	• Suburbia disagree about -ve impact on society, (ruralis range from SD to A with several NV) Why ?
	• Suburbia ambivalent or negative about values importance, views vary from ruralis (SD-D-NV-A). Explore values issue.

Ruralis

Technological Capability

- Differences
  - Work with constraints & limited resources
    Ruralis 67% Suburbia 0%
  - Make value judgments regarding actions whilst d
    Ruralis 67% Suburbia 0%

Discussion Of Projects ~ Ruralis & Suburbia Studen

	Ruralis	Suburbia
Q14 Project Experiences	Strongest in Design	Strongest in Electronics
Q15 Community Projects	Entrance Hall Project Interior Design Project	Toy Paperweight. Lamp Timer

Mention ~ big rural machinery (sponsored)
glass houses in Tower Hamlets

Q16 Others Shoes

Poor Question 1/12 Responses

Probe this area

DISCUSSION WITH RURALS & SUBURBIA STUDENTS

- Explain what the purpose is ~ 2 min
- Triangulate data ~ 10 min
- Discussion ~ 45 min
- Rounding up ~

I have established that there is common understanding of what DET is (+ not) ~ general/specific characteristics.

What I now need to ascertain

Codings ~ A ~ CB
B ~ FE
C ~ JI
D? ~ CT

A ~ ND
B ~ CB
C ~ BC
D ~ MH
E ~ WH
F ~ AM
G? ~
H? ~

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

APPENDIX 6

CONCLUSION

"THE WIDER [EDUCATION] DEBATE IS AS MUCH ABOUT HOW SCHOOLS AND PROFESSIONALS RESPOND TO THE DIFFERENTIATED NEEDS OF THE COMMUNITIES THEY SERVE AS IT IS ABOUT THE CENTRE HOLDING CIVIL SOCIETY IN THRALL TO A MONOLITHIC VISION"

STEPHEN BALL 1994

1999 KEITH ATKINSON

Appendix 6.1

Coherence & Integration ~ ReportIII

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

COHERENCE & INTEGRATION REPORT

- YEAR III -

KEITH ATKINSON

JULY 1999

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

COHERENCE & INTEGRATION REPORT - YR III

JULY 1999 KEITH ATKINSON

'Three stone cutters were asked about their jobs. The first said he was paid to cut stones. The second replied that he used special techniques to shape stones in an exceptional way, and proceeded to demonstrate his skills. The third stone cutter just smiled and said "I build cathedrals". '

Bhindi & Duignan (1997, p.125)

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

COHERENCE & INTEGRATION REPORT - YR III

JULY 1999 KEITH ATKINSON

Abstract

A three year doctoral journey involving an interplay between taught elements, professional practice and personal development culminated in a 'Research Investigation'. Coherence & Integration III analyses the effect that being taught *Ways of Seeing, Management of Change and Research Methods in a Dynamic Context* had upon an individual practitioner, marking notable landmarks during the intellectual sojourn, enabling the 'Research Investigation' to be contextualised and (hopefully) comprehended. Reflection upon original educational beliefs, as contrasted with emergent ontological and epistemological thoughts provide testamental commentary on formative (process) and summative (product) change. Coherence & Integration III is not 'terminal', constant questioning and reflection endure.

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

COHERENCE & INTEGRATION REPORT - YR III

INTRODUCTION

JULY 1999

KEITH ATKINSON

Introduction

A cautionary note must be sounded for colleagues who may view a doctorate in education as an aide to accelerated ascent in the 'rat race' of promotion within the teaching profession. Honesty dictates that I must acknowledge my own (hopefully) former shallowness in expecting this to be the case, the reality has been (thankfully) somewhat different.

In the academic year 1996-1997 I had attended a number of interviews for senior management positions, finding the time to balance the demands of the profession with year 1 of the doctoral programme. As the course progressed I began to realise that my quest should be that of living a creative existence, instead of simply aiming to climb as high as possible, as quickly as possible. I now clearly feel that it is the style and manner of ascent that are as important as the altitude gained. I cannot pretend that I do not wish to ascend further, it's just that the map I navigate by now contains a plethora of interesting features and not just one path to the summit of the highest point.

As network manager in my current school I have spent recent weeks using a 'millennium bug' patching disc to ensure that our computers work effectively for the foreseeable future. I feel that actively participating with vigour in the doctoral programme at Nottingham Trent University over the past three years has had the same effect upon myself !

Including the introduction, this report is split up into eight sections. The second deals with how the 'Research Investigation' was shaped by the taught modules (*Ways of Seeing*, *Management of Change* and *Research Methods in a Dynamic Context*). This includes a discussion on how themes of context, resilience, values, individuality, change, life-long learning, leadership and research/reflection/complexity emerged from my work during year 1 of the course. How these combined with the dominant strands of year 2: superficiality, context, individualism, tensions, evaluation and values is then explored, as is the effect that 'common emergent stands' from both reports had upon myself as a teacher-researcher. The common themes that emerged over the three years of taught modules, being of importance to myself, were context, individuality and values.

Section Three assesses and evaluates the extent to which Coherence and Integration Reports I and II helped to shape the Research Investigation, making explicit why notions of context, individuality and values came to play such a central rôle.

The relationship between the Research Investigation and the doctoral journey is the subject of section four. An emphasis on contextual issues, along with the development of my own capability are discussed, as is the effect that the scheme as a dynamic, iterative whole had upon my own values and beliefs, both personal and professional.

Reflecting back upon my 'platform of educational beliefs' as declared in January 1997, in section five, and comparing them with those I now espouse provides perhaps the clearest snapshot of how I have evolved as a professional educator over the past three years. A measure of my personal development may be the discomfort I feel when reading what I thought was central to good educational practice three years ago.

Tangible changes that I personally feel have occurred as the doctoral programme washed over me makes up section six. Included in this section are professional and personal facets that lead me to feel much less like an educational 'Epsilon Minus Moron' (Huxley, 1932) than I perceived at the start of the programme in 1996.

Section seven flows directly on from section six and amplifies the remarks made in the first paragraph of this introduction concerning 'original wants'. It compares and contrasts these with what I feel have been significant 'acquisitions' as the journey nears its end. The word acquisition must not be interpreted materialistically.

The final section is a conclusive reflection on the explicit, the implicit, and the personal or unique.

This report is not intended as a factual document allowing for quantitative measurement or justification, it is an acknowledgement of a journey, my own version of a guide to an educational 'Pennine Way' or long distance footpath. Whilst it is submitted in partial fulfilment of the requirements of The Nottingham Trent University for the degree of Doctorate in Education, it may be that this report is ultimately only of practical use to myself as a unique teacher researcher. At the end of the journey I feel comfortable with such a notion.

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

COHERENCE & INTEGRATION REPORT - YR III

HOW THE RESEARCH INVESTIGATION WAS SHAPED BY THE TAUGHT MODULES

JULY 1999

KEITH ATKINSON

How the 'Research Investigation' was shaped by the Taught Modules

I have been able to synthesise three themes of personal significance as a result of fully engaging with the content of the taught modules. The aim of this section of C&I III is to tease out and make explicit how three years of work at doctoral level can be summed up in three issues of personal significance: *context*, *individuality* and *values*. In section five of this report I demonstrate how these three strands have significantly impacted upon my platform of educational beliefs, as personally espoused towards the end of the doctoral journey.

Coherence & Integration ~ Report I

As a technologist, coming from a background of 'pure' mathematics, expressing clear faith in quantitative research, I found the year 1 topics and subsequent discussions in the 'Ways of Seeing' module to be both challenging and revelatory. Issues concerning postmodernism, contested knowledge, modernity, utopias, ontology, epistemology, individuality & culture, phenomenology, and individuality and context are themes that have demonstrably shaped subsequent C&I reports, the Research Investigation and the way I now operate as an educationalist. I have engaged actively with the work of Schön, Popper and Foucault, and acknowledge the role of micro-circulations of power, the power of reflective practice and the importance of constantly questioning what is truth, as perceived by myself, to be useful and potentially powerful notions. These I have taken from the course and have been able to bring to bear in my evolutionary development as an educational practitioner.

The potential of the concepts we explored as a group in the ways of seeing module to assist in the management of change were not immediately apparent to me, becoming more evident only when I wrote my C&I I in July 1997. I came to realise how this work complimented and added other facets to the topics we discussed in the 'Ways of Seeing' module. I particularly became interested in the meanings and sources of change, from both objective and subjective perspectives.

I also reflected on the importance I discerned on the role that individuals play in the causes and processes of the initiation of change. Having been involved in leading change in a 'run down' and divided department of home economics and CDT, I was able to see how some of my successful strategies for building teams fitted within wider issues to do with managing educational change. From this work I began to realise the importance of individuals and individuality, a theme that proved to be central to my subsequent work on the course.

When considering the management of the sublime, conflict and multiple meanings, with reference to planning, doing and coping with change I also began to realise how important it was to myself as an individual to pay due attention to complexity, resisting the urge to quickly yield to simplicity. In my research investigation I refer to the notion of expressing complex ideas most effectively in the simplest language (1999, section 2.6.1.2). Simplicity, I posit, is positive when concerned with making accessible difficult or complex ideas, but equally can be associated with the negative if a result of shallow or confused thinking.

During the same module we discussed at length the notion of negotiation, ongoing review and reflection, and I teased out a strand in my report that made specific reference to the importance of evaluation in the process of education. Linking the notion of heuristics to management, I was able to make a strong link between my experience of middle-management and less formal knowledge, such as common sense, intuition, practical knowledge, subjectivism, parallel thinking and connectivity. My subject specialism of technology makes claims to be steeped in 'practical knowledge'. The consideration of acknowledging legitimacy or formally recognising such an epistemology was the source of my research investigation on technological capability.

My Research Investigation was also significantly shaped by the 'Research Methods' module, as was my own personal philosophy concerning the current debate on qualitative versus quantitative research. From a mathematical background, my C&I reports and Research Investigation methodology chart my transition to having a broader appreciation of both qualitative and quantitative traditions. A testament to this is the fact that I chose 'Action Research' as my principal method in the Research Investigation.

During the module on research methods, I engaged with the debate between Hargreaves and Hammersley regarding practical applicability of educational research, as well as looking at research for authoritative, perspectival, deductive, inductive and scientific purposes. When interpreting 'research' I became aware of the personal importance I began to attach to issues concerning values and context specificity when generating, interpreting and disseminating research findings.

My first Coherence and Integration report contained eight strands: **Context**, Resilience, **Values**, **Individuality**, Leadership, Research/Reflection/Complexity, Change and Life-Long Learning. The three highlighted went on to impact significantly on other aspects of the course.

Coherence & Integration ~ Report II

This report required the integration of taught modules and individual work to tease out a number of 'themes' or 'strands' to help describe a journey through the year's course, whilst also indicating how the resulting journey shaped the 'Research Investigation Proposal'. Paradoxically, although I found this both challenging and frustrating during the Summer of 1998, I subsequently found it to be of benefit when undertaking the Research Investigation and also when compiling C&I III.

I settled upon six 'strands' or 'themes': Superficiality, **Context, Individuality,** Tensions, Evaluation, and **Values.**

The theme of superficiality came out of the work done on recent history and politics of education, including a consideration of the work of Ball (1997) looking at the notion of the nature of knowledge being politically loaded, and the apparent fluctuation in the fortunes of the notion of modernity vis-a-vis educational and political thinking. Issues surrounding recent uses and apparent abuses of educational research and a consideration of the management of honesty and integrity also shaped my thinking on superficiality.

A consideration of the importance of contextuality was borne out of work on reflections of past experiences, as well as discussing of the importance of the environment within which educational management takes place. A major influence on my Research Investigation also occurred when one of our group discussions during the 'Ways of Seeing' module touched on the notion of linking the cognitive with the affective within specific contexts. This proved to be the catalyst for an exploration of an idea I had regarding whether technological capability was the same for children in rural, suburban and urban contexts. Having taught in schools situated in all three environments, I was keen to explore this for my Research Investigation.

Regarding Individuality, the work done on the link between different cultures, including the Navajo Indians, and the notion of individuality and society proved to be most illuminating ontologically. Expressing one's individuality by unswerving dedication to teamwork was a concept that I had not considered, and has subsequently been one facet of my management philosophy as a practitioner. This notion also impacted on how, as a group we explored the notion of teachers as individuals, and as reflective learners.

Although it proved not to be a strand that I explicitly carried into year three of the doctorate I became interested in tensions and dialectics, especially as they related to the purposes, context and delivery of education. National league tables in Education, early narrowing into subject specialisation, as discussed by Pring (1994), and the interplay between social constructivism and scientific truth or 'fact' were all issues that made clear the notion of tension within educational practice.
Leadership, seemingly requiring individuals to be both authoritative and judgmental but also involving active listening and team building, also raised issues to do with paradox and tension both within our discussion group and for myself as an individual.

Regarding the notion of centralised research as equating to 'useful' research, I continued to reflect upon the debate between the Hargreavsian 'doctors in white coats' perspective, and that put forward by Hammersley, postulating that research is largely context specific and does not translate easily into the generalisable. This analysis of educational research I broadened out to include a consideration of the potential for conflicts of values in undertaking contract or international research.

The fifth strand I made explicit in C&I II concerned evaluation. I made a tentative exploration of the link between capability and evaluative reflection, citing the work of Ball (1995) in developing the notion of an 'evaluative pace back' as enabling a link to be developed between cognition and affectation. Regarding reflection in practice a Norwegian model was analysed to note that it was claimed that reflection in practice affected action, theory and ethics. Developing this notion to encompass management of change, Griffiths (1993) unequivocally argues that reflection is a necessity, not an option for change.

In linking together the notion of reflection and evaluation I argued in C&I II that the construction of a web of relationships, drawing upon a wide range of epistomological, political and sociological perspectives, might create a more stable framework against which seemingly complex concepts such as technological capability and educational change might be nurtured and evaluated.

Of all of the strands made explicit in C&I II the one that proved to be the most thought provoking to me personally concerned the consideration and exploration of values. The work of Abraham (1996) highlighting the fact that SATs appeared to place absolute faith in the logical positivist 'received view' of the Vienna Circle. Contrasting this with the view of Ball (1995) that society cannot be rounded up and compartmentalised in a bland rationalist empirical manner, I reflected at length on how such a notion might impact upon technological capability and design and technology education.

When I read an article by Pring (1995) suggesting that educational research should be concerned with understanding individuals and how they think, feel and grow within the world they inhabit, I began to see clearly how I could write my 'Research Investigation Proposal' and which research methodology I would actively engage with.

I had not genuinely been consciously aware that in both C&I I and C&I II I had drawn out the same themes of *Context*, *Individuality* and *Values*. When I did make this link I began to appreciate how important these dimensions of educational practice had become to myself as a reflective practitioner. The next section reflects upon how these three recurring themes helped to shape the Research Investigation.

THE NOTTINGHAM TRENT UNIVERSITY

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COHERENCE & INTEGRATION REPORT - YR III

HOW THE COHERENCE & INTEGRATION REPORTS I & II HELPED TO SHAPE THE RESEARCH INVESTIGATION

JULY 1999

KEITH ATKINSON

How Coherence & Integration Reports 1 & 2 helped to shape the Research Investigation

The previous section indicated the extent to which the doctoral programme necessarily actively encouraged candidates to range across a wide variety of issues and topics, covering some in depth. Depth occurred largely due to recurrence of theme or as a result of the pursuit of individual interest.

This section is concerned with convergence, a point acknowledged by me in feeling confident to be able to synthesise three years of taught modules down to three key themes of *context*, *individual* and *values* that I identify as having significant personal meaning to myself as an practising educationalist.

Context

In C&I I, an analysis of short term superficial political changes coupled with the leaching of power leading to cynicism and passivity within education enabled me to perceive a strong bond between the three taught modules and my own professional practice. A quote I used by Mulford (1994) summed up the feelings of many colleagues within the profession with whom I had worked for nearly fifteen years:

> "school people have been badly disillusioned by the galloping hoof beats of those itinerant education peddlers who ride in and out again exhorting the latest elixir."
> (p.21)

Given such a climate, I found the requirement to compose Coherence and Integration reports both rewarding and a key mechanism in helping myself as a teacher researcher to reassess my own educational philosophy and how resultant changes in my professional beliefs might manifest themselves in my subsequent practice, both classroom and management.

In C&I II, I drew attention to the powerful potential that reflection and past experience held for myself, in identifying successful elements of the many curriculum developments I had undertaken in well over a decade of practice. Although many local and national initiatives become shelved in favour of 'new' or 'improved' models or systems, I have discerned many useful 'nuggets' of good practice, enduring knowledge or valuable resources from deconstructing such schemes to try and raise the standard of my own teaching.

In the second C&I report I also acknowledged the central role that context specificity appeared to play in research within education. The current debate mentioned in the previous section helped to shape my own views, and led me not to view qualitative and quantitative research as two extremes of a continuum (evoking polemical notions of 'good' and 'evil', 'right' or 'wrong', 'rigorous' or 'Mickey Mouse') with one's research activity depending upon which camp one frequented. I now view educational research much more as an eclectic process, employing a variety of methods to help develop an appropriate and cohesive methodology.

The work of Ely et al (1991, 1997), recommended to me through a taught module discussion group, was instrumental in my viewing the 'welding' of a range of research methods together to form a cogent research methodology. The importance of developing a specific research methodology for each specific piece of research became increasingly apparent, an acknowledgement that was useful when designing my Research Investigation Proposal and also undertaking the Research Investigation itself.

Other issues pertaining to context specificity alluded to in C&I II included the environment of educational management and the definition and contextualisation of capability, something that proved to be central to my subsequent research investigation.

A consideration of recent developments within the business community of forming 'specific business units' and 'small and medium enterprises' to operate within specific contexts, such as niche markets, formed part of the 'Management of Change' module in year 3. A link between these points and the final 'Ways of Seeing' module, in addressing change from ecological, cultural and personal change, became explicit to me and also led me to link the notions of context and individual together.

Individual

In both C&I I, and the introduction to C&I III, I made reference to feeling like one of Aldous Huxley's 'Epsilon Minus Morons' after actively pursuing a teaching career for a period approaching fifteen years, without substantial reflection. Being both a classroom teacher and middle manager, a quote by Bottery and Wright (1997) captured my evolving perception:

> "..... if teachers and schools continued to lower their heads and pull their classroom or management carts, it should come as no surprise if they ended up at destinations they did not select."
> (p.11)

C&I I drew attention to the importance of contemplating utopian discourses, as a means of counterbalancing daily practice, or at least locating it within a wider perspective.

The teacher as Individual reflective learner was a theme contained within my C&I I, and revisited in the work of year 3 of the course when discussing the 'new' Labour government initiative of 'life-long learning'. From a personal perspective I can clearly discern a link between the notion of life-long learning and issues pertaining to the management and development of the individual, as discussed on p.26 of C&I II and those of individuality and society on p.22 of the same report.

Work linked to the 'Ways of Seeing' module from 3rd March 1999 on personal change, and that undertaken during 'Management of Change' from 2nd December 1998 on the importance of the individual in helping to effect a 'culture for achievement', both reinforced my growing recognition of the importance of my rediscovering the importance of singularity and uniqueness. Such a fundamental reconceptualisation led me to analyse the values that underpin my current professional practice, and to explore the concept of values within education more widely.

Values

Individual growth and development was a dominant theme of C&I I (pp.51-52), with Mulford (1994) making explicit a link with values by suggesting that:

> "the mission of education is defined by a coherent vision of the kind of world we want our youth to inherit...... A vision of the values that students will need in order to cope and flourish in the world. " (p.23)

Although I personally believe that values are a uniquely personal set of tenets by which one functions within society, I accept that making known one's own personal beliefs may well influence children. I am also currently of the opinion that values are not necessarily things which necessarily lend themselves to being 'taught' meaningfully in an explicit or mechanistic manner. Although this report suggests that my own values appear to have changed significantly over the past three years, I cannot recall one occasion during the doctoral journey where I have been 'taught' that any particular value is necessarily preferable to another. The growth and development of my current perspective can be traced through both C&I I (p.50) and C&I II (p.50).

Also in C&I I, I suggested that values within education were in part concerned with the type of world we wanted our children to inherit (p.50) and, as such, one important consideration of documentation produced should be the ease with which values are recognisable within any given proposal.

This was a theme I echoed in C&I II (pp.51-52), by recognising that in affecting cultural change, making explicit the 'why' was perhaps as important as the 'what' and 'how'. In the year 3 work undertaken during the 'Management of Change' module the centrality of importance of values and vision in the management of change as affecting individuals within an organisation was discussed on 4th November 1998. I felt able to discern how this built upon or complemented the work of previous C&I reports.

Reflective Remarks

Having coincidentally been actively considering the themes of *context*, the *individual* and *values* at length over a period approaching three years in duration, I began to realise that a consideration of technological capability, and design and technology education, in different contexts would allude to issues of individuality, values and contextuality, and as such impact upon the Research Investigation with significance.

THE NOTTINGHAM TRENT UNIVERSITY

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COHERENCE & INTEGRATION REPORT - YR III

THE RESEARCH INVESTIGATION AND THE DOCTORAL JOURNEY

JULY 1999

KEITH ATKINSON

The Research Investigation and the Doctoral Journey

Included in Appendix 4 of this report is a copy of the 'overall shape' of my Research Investigation. Although it underwent a process of several metamorphic transformations, the basic structure has remained intact throughout.

The three key issues of context, the individual and values can be identified as being present throughout the structure of the Research Investigation.

Context

Chapter 2 related to contextual issues of myself as reflective teacher researcher, and grew to be over 23000 words in length. I found the task of reflecting upon my own professional context and relating it to developments within design and technology education over the past decade to have been most enlightening in terms of me being able to locate and justify my own personal educational beliefs at the end of the twentieth century.

An historical analysis of the growth of technology education from Plato to the mid 1980s, and from the introduction of the National Curriculum in 1988 to the present day enabled me to reappraise the what, why, when and how of the teaching of technology education from a personal perspective. This analysis led on to a personal reflection concerning the fundamentals of teaching, thinking, learning and knowledge as they impacted upon this specific study. This aided me in contextualising the work and relating it to my professional practice.

Contextual work in Chapter 3 included an analysis of how rural and suburban contexts may affect capability, and looked in detail at the notions of embedded knowledge and knowledge transferability.

The analysis of the questionnaire data from action cycle 1, and from the taped interviews in action cycle 2 required consideration to be given to the contexts in which the different schools operated. It was felt that failure to take into account contextual dimensions would diminish the legitimacy and therefore potentially the quality of the data gathered.

The conclusion makes explicit the fact that this Research Investigation makes no claim to being able to be generalised. Concerning specific environments and myself as unique individual, the importance of context permeates the whole report.

The Individual

The doctoral journey has been about the personal development of professional practitioners. Having elected to use Action Research as my chosen methodology, perhaps in part acknowledging the implicit importance placed on the individual throughout all aspects of the course, including the Research Investigation.

In the introductory chapter I described my own professional journey to date. This was followed by my charting the development of technology education from a personal perspective.

In Chapter 5 my analysis of results required me to make explicit my own values when interpreting the data I had gathered. The subsequent reporting of findings included a reflection upon what the results said to myself as unique individual and practitioner-researcher. Factors affecting my reporting of the findings and conclusions were also made explicit in Chapter 7.

Values

The Introduction (Chapter 1) contains an explicit reference to values and ethics, acknowledging the strong commitment I had made to values within my practice, my Master of Arts thesis (Atkinson, 1996), and its presence in much of the doctoral work I have engaged with over a three year period. In Chapter 5, as indicated in the previous section on '*the individual*' I felt it important to make clear my own values position in presenting an interpretation of the data accrued.

Working in a school that has a well established values-led curriculum, I felt that my engagement with values both consolidated and enhanced my perception, given that the doctoral programme allowed me to consider values within a wider frame of reference than I had previously.

When read in conjunction with C&I III, it is my belief that the reader will be able to discern the facets of context, the individual and values, and witness their sustained presence throughout the Research Investigation.

THE NOTTINGHAM TRENT UNIVERSITY

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COHERENCE & INTEGRATION REPORT - YR III

A REVIEW OF MY ORIGINAL
(APRIL 1997)

PLATFORM
OF
EDUCATIONAL BELIEFS

JULY 1999

KEITH ATKINSON

A Review of my original Platform Of Educational Beliefs

Of the ten statements in my original platform of educational beliefs only four remain largely intact, contributing significantly to my new 'slimmer' platform!

My belief that rigorous and measurable ≅ challenge now appears to be somewhat in tatters following the doctoral journey bringing me into contact with postmodernism, Karl Popper and the notion of qualitative research, all of which are discussed elsewhere in the report. Challenge I now perceive to be largely context specific, not necessarily measured mathematically, as I implied in 1997.

Regarding open styles of management, the work done on 'management of change' and 'ways of seeing' would lead me to believe that such a view is perhaps a little naïve. Whilst retaining the sentiment that such a notion exudes, I would now contend that a reflective style of management is important, paying due attention to the needs of all of the community, pupils, parents, staff and governors. However I must emphasise that my new platform does not contain a statement about management.

The comment on political changes I believe to be time related, being overtaken by subsequent events (General Election). I personally now view this statement as simplistic and my new platform contains no reference to the body politic.

As I appear to have forgotten what the statement regarding 'forgiveness but not forgetfulness' means, I have not included a variation in my new platform!

Regarding the status of subjects on the curriculum, as I have thought deeply about what creates subject uniqueness, arriving at the conclusion that it perhaps concerns specific combinations of command verbs ~ see 3.1.6 in the Research Investigation, I feel that such a comment, whilst perhaps retaining credence now appears to be a little gauche to myself.

As a teacher of technology the notion of 'hands on' learning goes to the core of our *raison d'etre.* Whilst I am still drawn to such a notion it is expressed somewhat differently, given that I now feel to be operating from a much wider and deeper perspective. The same can be attributed to my comments on schooling being fun.

<u>Platform of Educational Beliefs ~ July 1999</u>

- All humans are unique individuals; what children need to learn at 16 they need to learn at 5, albeit presented differently.
- Values are central to all educational activities: learning, teaching, thinking, epistemics and management. They should be omnipresent and subject to the possibility of agreement by all sections of the school community. Values within education have ontological dimensions.
- Acknowledgement of the importance of context is central to the development of effective education effective education.
- The development of enquiring minds is important throughout the whole community; pupils, parents, staff and governors. Questioning is healthy. Practical action resulting from questioning has the potential to be purposeful and powerful.
- Reflection is vital, and should be a natural part of the learning process for the whole school community.
- Teamwork is a vital ingredient to the strength of many communities.

These beliefs are time related, it is my fervent hope that they are not the same three year's hence. They are my own beliefs, not a list to be deemed 'right' or 'wrong'. I do, however enjoy discussing them openly!

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

COHERENCE & INTEGRATION REPORT - YR III

PROFESSIONAL AND PERSONAL CHANGES

RESULTING FROM

THE DOCTORAL JOURNEY

JULY 1999

KEITH ATKINSON

Personal and Professional Changes resulting from the Doctoral Journey

One of the unexpected outcomes for myself personally has been the tangible difference that the doctoral process has effected in me as a person, in addition to those I expected as a professional.

Professional

The constant reflection and questioning that I now mentally perform are a result of the taught elements, group discussions and personal research I have participated in during the taught doctorate. Deconstruction, postmodernism, dialectics and hermeneutics have been major facilitative conceptual building blocks.

I find myself actively seeking out the views of others, trying to understand and engage with different perspectives. This I have found especially useful in looking more deeply and wider at issues that surround change, and the management of change.

In acknowledging the importance of individuals within team building, and endeavouring to create an ethos within which team loyalty becomes a strong motivational factor, I have endeavoured to create a situation where values permeate the whole and due consideration is given to regular reflective practice and planning. The acknowledgement of the importance of sensitivity to context is also a tangible professional change, paying due attention to what lessons history can teach us as practitioners.

Personal

The personal benefits have been quite unexpected, yet most welcome. In general terms those with whom I work, and particularly those I live with have commented that my levels of tolerance have increased as the course has progressed. Whilst the impact of the effect of time cannot be evaluated with certainty, I do feel that experiencing a plethora of different perspectives and wide range of materials has made me more able to see other's perspectives more readily than used to be the case.

I feel able to more readily express my appreciation of other's efforts This I feel is a result of becoming committed in a meaningful way to the notion of reflective practice. Prior to the doctorate in education I was very much a 'lead from the front', let's get this problem by the 'scruff of the neck' type person, whereas now we tend to meet regularly, agree a consensus view on issues that need addressing and I appear to delegate more effectively than in the past. Although I have used an example from my professional practice, both I and those who surround me see this as a change in my person that has been in evidence both at school and within the wider community in which I live with my family.

My range of reading has become wider, I now read for pleasure to a greater extent than was the case prior to 1997. I do not read necessarily to become more intelligent, but I do find myself exploring links and making connections between books and more widely, as was required at doctoral level. Having referred to C. P. Snow's notion that within us all lurks a monster that is awoken when our sense of reason is left dormant, I feel confident that I will no longer be content to simply 'go with the flow', either as an individual or as a practitioner. The reputation I appear to have acquired as being efficient and a confident communicator has not been 'won' with ease. Balancing the demands of a full time job with doctoral level work and a young family has not been easy. My children were 39 months and 17 months old respectively at the start of the doctoral journey. The care, love and support my wife Joanne has shown me has been a genuinely humbling experience. This too has had a profound effect upon me and is an indirect result of my participating on the course.

Whilst I am sure I neither want, nor would ever attain the status of being an 'Alpha Plus Intellectual' a final personal benefit the course has provided has been in giving me the confidence to shake off my eleven-plus failure, and to stop viewing myself as an 'Epsilon Minus Moron'. To those who have contributed to this happy situation, I shall always be grateful. I feel to be a beneficiary of education that is targeted at social justice.

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

COHERENCE & INTEGRATION REPORT · YR III

THE DOCTORAL JOURNEY

▫

ORIGINAL 'WANTS' & SUBSEQUENT 'ACQUISITIONS'

JULY 1999

KEITH ATKINSON

The Doctoral Journey ~ Original 'Wants' and Subsequent 'Acquisitions'

As I neared the end of the doctoral journey I decided to think about the real reasons that I applied to study at doctoral level, and compare them to what I now feel I actually have ended up with at the end of the journey. Where possible I have expressed wants and acquisitions in as straight forward way as possible, whilst still retaining meaning. It is an attempt at honesty, not a catalyst intended to provoke discussion.

Wants

- A foot up in the promotion 'rat race'
- To be 'made' more intelligent
- To know if I could make the grade at doctoral level
- Gain more qualifications

Acquisitions

- Gained a wide experience of concepts and models with which to consider and manage change
- A broad vision of education ~ encompassing ontological and epistemological dimensions
- The ability to order thoughts quickly in my head, and to shape cogent arguments
- Increased confidence in both written and verbal communication
- Experience of high quality Inset, partly as a result of my own enthusiasm, but mainly due to the quality of partnership generated with those who 'delivered' the doctoral programme

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

COHERENCE & INTEGRATION REPORT - YR III

CONCLUSIVE REMARKS

- THE EXPLICIT
- THE IMPLICIT
- THE PERSONAL AND POSSIBLY UNIQUE

JULY 1999

KEITH ATKINSON

Conclusive Remarks on the Doctoral Journey

Like the memorable journeys I have been fortunate to undertake as an Alpinist, walker and rock climber, the pleasure is gained from participation and random memory recall. I have never subjected any of my memorable journeys to minute analysis, and I do not intend to with the doctorate, one of the most arduous I have undertaken.

There are explicit, implicit and personal conclusive remarks that may help others to judge myself, the course or both.

Explicit

- My grasp of research methods and methodology was broadened in theory and practice
- All aspects of the course emphasised the importance of context
- Attention to individuality was another all pervasive feature of the programme
- I now feel comfortable with the broad concepts concerning post modernism, modernity, utopias, action research and dialectics

Implicit

- Being driven and self motivated, learning to rise to some of the challenges that uncertainty and complexity pose
- Not being content to do just enough but to take a pride in active engagement ~ (I missed only three sessions over the three years)
- Reading widely, using a variety of sources, including new and unfamiliar media

- Reflecting in depth, borne out of undertaking work at doctoral level over a protracted timescale
- Constantly drafting and re-drafting, making corrections and attempting to pursue excellence

Personal

- Feeling a real sense of achievement
- Supported deliverers by high attendance and trying to ensure they were given due respect
- Always appearing positive and accepting all put before the group with graciousness
- Trying to smile and have fun
- Aiming to understand others' perspectives
- Feeling locked in a 'hermeneutic loop'! (attempting to find out more about myself in an attempt to become a 'more accomplished' professional)
- Endeavoured to maintain a high standard of work when under pressure at work and at home

C&I Report ~ 6094 words, excluding quotations

The Nottingham Trent University

Doctorate in Education

Technological Capability within Rural and Suburban Contexts

Conclusive Remarks

* Unsure at the start
* Fully engaged with the course
* Clearer about myself as educator ~ reflective
* Clearer about ontological and epistemological facets of technology and technology education
* Frustrated that research investigation raised more questions/avenues than I could answer/explore
* Made me anxious/restless about exactly how little I know
* Affected my thought processes ~ ordering arguments in my head and how I articulate myself on paper
* My own answer to what a doctorate is:
  Taking nothing for granted, constant questioning and reflection

Keith Atkinson **May 1999**

SEMINAR PRESENTATION ~ 12

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

COHERENCE & INTEGRATION REPORT - YR III

APPENDIX 1

- REFERENCES -

JULY 1999

KEITH ATKINSON

BIBLIOGRAPHY for Coherence & Integration Report III

KEY: WOS = Ways of Seeing, MOC = Management of Change, RM = Research Methods in a Dynamic Context, C&I = Coherence and Integration, RIP = Research Investigation Proposal, RI = Research Investigation

Author(s)	Year	Title/Journal	Publisher/Volume	Location
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Griffiths, M.	(1993)	"Educational Change and the Self" <u>British Journal of Educational Studies</u>	Volume 41, No. 2	MOC
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Hargreaves, D.	(1997a)	"Teaching as a Research Based Profession: possibilities and prospects" <u>Teacher Training Association Annual Lecture</u>	TTA: London	C&I
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Hargreaves, D.	(1997c)	"In Defence of Research for Evidence-based Teaching: a rejoinder to Martyn Hammersley" <u>British Educational Research Journal</u>	Volume 23, No. 4	RM
Huxley, A.	(1932)	<u>Brave New World</u>	London: Chatto & Windus	
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Schon, D.	(1987)	<u>Educating the reflective Practitioner</u>	Jossey-Bass: London	C&I
Snow, C. P.	(1969)	<u>The Sleep of Reason</u>	Penguin: Oxford	

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THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

COHERENCE & INTEGRATION REPORT - YR III

APPENDIX 2

- WORKING DEFINITION OF TECHNOLOGICAL CAPABILITY -

JULY 1999

KEITH ATKINSON

The Nottingham Trent University

Doctorate in Education

Technological Capability within Rural and Suburban Contexts

Defining Technological Capability

In a post modern world, capability, as it relates to technology education (D&T), is, in varying degrees, at various times:

* Reflective ~ Historically and Personally
* Volitional
* Humanist
* a Process
* an Academic Discipline
* an Outcome
* Economic / Vocational

Keith Atkinson **May 1999**

SEMINAR PRESENTATION ~ 10

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

COHERENCE & INTEGRATION REPORT - YR III

APPENDIX 3

- ORIGINAL RESEARCH INVESTIGATION PROPOSAL -

JULY 1999

KEITH ATKINSON

THE NOTTINGHAM TRENT UNIVERSITY
DOCTORATE IN EDUCATION

RESEARCH INVESTIGATION PROPOSAL

25TH FEBRUARY 1998 KEITH ATKINSON

THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

RESEARCH INVESTIGATION PROPOSAL

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25TH FEBRUARY 1998 KEITH ATKINSON

RESEARCH INVESTIGATION PROPOSAL

Research Question (102)

"Is the acquisition of technological capability uniform within rural and urban contexts?"

It is suggested that a natural focus for the enquiry might well be at the post 16 phase of secondary education where all students will have undertaken some form of explicit technological education at GCSE level, following the requirements of the National Curriculum in England and Wales for the 1996-98 cohort of Year 11 students. (This cohort being the first to undertake the 'Dearing' syllabuses, whose introduction supposedly heralded a more uniform range of technological syllabuses as well as a proposed moratorium on syllabus change through to the year 2000).

Theoretical context (281)

The Open University have been leaders in the field of looking at technology and society. MacKenzie and Wajcman(1985), Cross et al (1974), Boyle et al (1984) and Semper Ed (1976) are indicative of the work done in contextualising technology within society and looking at the impact it has had. Pacey (1983) is noted for his work on the culture of technology and the work I did on values within design and technological education for my Master of Arts degree has shaped my approach to the notion of technological capability. I have also been looking at the notion of social constructs and how they might impact upon the area of my studies.

Regarding the teaching of technology education I have revisited much of the work of Professor Harrison from Trent Polytechnic, as well as using the many books and journals that I have used throughout my teaching career. It can be observed from the initial references in Appendix 1 that I have used articles from sociology, cognitive development, educational research bodies, psychology and government bodies in an attempt to provide a firm basis from which to explore a challenging topic. Although much of the material is informative and broadly relevant, I do think there is a need to generate further research into the notion of technological capability within the field of education.

The work of Bruner(1966,1969,1987,1996) on how children think and the spiral curriculum has been explored and the notion of the school curriculum and how it might relate to student acquisition of technological capability has also formed part of my theoretical work.

In Appendix 2 are many examples of articles on technological capability from the international community obtained via the Internet.

Methodological approaches (363)

Due to the nature of the research question, involving human beings and questions of capability within different social contexts, it is thought at this stage in the proposal that the investigation would tend towards the qualitative tradition of research. There may be some statistical analysis that would be generated out of a survey of students and teaching staff. Should this prove necessary it would be for the purpose of giving greater clarity to the field interviews that might be conducted in a small sample of schools, rather than trying to create a legitimacy through the use of statistics. During the EdD course my investigations into research methods have blurred the boundaries (or sharp divisions) that I used to perceive between the qualitative and quantitative traditions.

Implicit in the research question is an acknowledgement that there are ontological questions concerning the nature and definition of technology itself, as it relates to different cultures. Also, Does the notion of technology equate to truth?, and What exactly does it mean to be capable? The very word technology has itself brought a lot of baggage with it into the educational world in recent years. From an epistemological perspective the investigation will need to address issues such as 'What is, and why have, technology education'?, Can one syllabus bridge rural and urban needs? (As well as possibly trying to address the notion of rural and urban needs as they relate to technological capability?)

It is envisaged that the investigation will involve small scale research, appropriate to the tight timescale that the EdD imposes. Due to this the Quasi-experimental approach would not be deemed to be practicable. Although a questionnaire would provide greater coverage of a population than a comparative study using 4 to 6 schools, it is felt that this would fail to provide an opportunity to tease out or amplify the thoughts and opinions of students and teachers on the seemingly complex issue of technological capability, and its acquisition.

As a caveat, it must be readily acknowledged that the small scale research that is proposed would hopefully provide a gateway into a larger area of research, rather than providing a definitive claim to knowledge or causal link. It is hoped that it would add to the small, but growing base of research into technological education in Britain. It is also a central aim of my proposal to be about me the individual gaining a greater understanding of the subject matter and processes involved.

<u>Data Collection</u> (416)

- **How Many** - It is envisaged that I will visit 4 to 6 schools in the East Midlands area, this being representative of a fair cross section of the British educational system. There would be 2 to 3 schools of each type - both 'rural' and 'urban'.
- **How chosen** - As I teach London Board 'A' level, it seems reasonable to select schools that do this syllabus. I have access to the lists of schools via the chief examiner. Once lists of urban and rural schools have been culled from the lists, a method such as using the National Lottery numbers for a particular week to select schools from numbered lists would seem to provide a random method for obtaining a sample from population. Should some pupils, staff, head teachers or governors provide unwilling to participate, perhaps lottery numbers from subsequent draws could be used.
- **Who** - VI form students and teachers\deliverers of the London Board (Edexcel) 'A' Level Design & Technology syllabus (9110). Typical sizes of groups would be 5-10 students and 1-2 staff. Each student and teacher would fill out a survey that I had dispatched to the school in advance of my visit. Out of the group I could select perhaps three students to interview, using a set pattern of pre-defined numbers. Students could be interviewed in a small group discussion situation, or individually. Although it is my intention to record discussions, I do not propose to do a transcription. I do propose to have a prompt sheet on which I make notes and record observations.
- **By Whom** - Keith Atkinson.
- **When** - Initial contact to be made in April 1998 (LVI students only, as UVI will be on exam leave)
    - Field work/interviews in Oct/Nov/Dec 1998.
    - Distillation/interpretation Dec/Xmas Vac/Jan/Feb/Mar.

- Begin writing up in January 1999.
- Survey completed and collected in at time of school visits.

- **What Research Tools** - *Interview* - taped - broad guidance/topics/areas of discussion provided by KA.
  - *Survey* - given to students and staff in advance of the visit to be taken away completed at the end of the visit.

To help me with research methodology, and as part of the taught elements of the EdD, I have been reading the following: Bell(1993), Cohen & Manion(1981), Cohen & Manion (1994), Ely (1991), Ely(1997), Robson(1993) and Yin(1994) (Please refer to Appendix 1). As a result of my readings my techniques will hopefully develop and possibly change from those outlined above, albeit in relatively minor ways.

<u>Ethical issues</u> (183)

Due to the method of obtaining schools to visit, via the Chief Examiner of the London Board 'A' Level(Andrew Breckon), is assumed that 'most' teachers will be willing, if not keen, to contribute to the growing body of research into design and technological education in Britain. Hopefully a covering letter addressed to all colleagues, from the chief examiner, introducing my research project would reassure colleagues, as well as helping me to overcome some of the potential hurdles. It is also assumed that if the staff are willing then the students would also be prepared to participate, acknowledging that attitudes amongst students may well be, but not necessarily, more variable.

Due to the nature of my enquiry, it does have to be a willing sample, even if this potentially skews the findings.

Anonymity should not prove to be a problem. I propose to send draft copies to the schools involved to ascertain as to whether they can discern their school to any significant extent, having first established with all schools prior to starting the enquiry as to the extent that this is an issue. It would also be important to take the time to explain to students the importance of research and the need to generate field research using students themselves as a source of valuable information.

<u>Gatekeepers and other hurdles</u> (220)

Headteachers of sample schools might be unwilling to participate. If this proves to be an issue I would return to the sample lists provided by the Chief Examiner and select other schools, repeating the process until the 4 or 6 schools had been obtained. I have built slack into the time line to allow for this possibility.

An afternoon per week in the timetable for the academic year 1998-99 would be highly desirable. I have got the broad approval of my senior management team as to the possibility of arranging this, with the proviso that if the timetable does not permit then other possibilities will need to be explored. (NB - I am one of the timetablers within my school !) If I cannot arrange this then I would have to arrange visits more locally during non-contact time, or arrange visits further afield after school, or during different holiday dates between LEA's.

I think that the schools would ideally be in the East Midlands region due to the time constraints. Within a 50 mile radius of Nottingham. Hopefully Nottinghamshire, Lincolnshire, Leicestershire, Derbyshire, South Yorkshire and the East Riding of Yorkshire could be used. If this proved not to be the case then a focus within one LEA might be possible, though possibly far less desirable.

Methods of analysis (168)

An initial analysis of the field discussions, via my guided notes and sheets, should enable themes to emerge and possible links to be explored. It is proposed to keep the tape recordings of the group (or individual) discussions, so that clarification can be sought arising from any ambiguity in my note taking. This should also provide evidence and legitimacy to my work in terms of being able to supply original evidence.

If it is possible to design the survey (that will be sent out for completion prior to my field visit) so that any meaningful statistical analysis can be done, such as the generation of confidence intervals, looking at any correlational work between students or schools from similar backgrounds, then this would be an advantage. It is important to stress again that in such a small sample the likelihood of being able to extrapolate on such a small sample would appear to be of little practical use. Please refer to paragraph 1 in the section on 'Methodological Approaches'.

Dissemination and writing up (207)

I hope to publish my research in the DATA (Design and Technology Association) Journal (3 issues per year). This journal has recently established a large research section, with the expressed intent of generating much more research into design and technological education in the United Kingdom.

I would also present finished copies of my work to all participating institutions, as well as lodging a copy of my final Research Investigation in the library at The Nottingham Trent University.

I would also welcome the opportunity to present my research to an audience, either at the Trent University, or at one of the conferences that are held on design and technological education within Europe in the academic year of 1998-1999. I would need help form my supervisors with this aspect of presentation to a 'live' audience.

It has also been an ambition of mine to take part in a video conferencing session, I would be keen to do this and explore the notions of technological capability within a Europe wide context. Failing this, I would like to present my work across a video conference to schools within the United Kingdom. It would, of course, be highly desirable to have a video conference with those schools which participated in my research.

Time scale (199)

In the hope that my RIP will be acceptable, even if it needs slight adjustments, I began my literature search during February Half Term. I spent two days in the Clifton Library (Thursday 18th and Saturday 21st February 1998). I used the BIDS data bases from the Internet Station, through the Nottingham Trent University Home Pages. I also researched many educational journals and photocopied some 200 articles, that I am currently reading for background knowledge. I also begun to look at the work of Bruner (see Appendix 1) on curriculum development and how children think. In Appendices 1, 2 and 3 there is a selective sample of the types of article that my initial searches have uncovered. It is not included as padding, merely to illustrate indicative reading and to show the type of progress I have already made.

Contact Andrew Breckon, Chief Examiner, in March 1998, subject to my RIP being accepted.

Initial contacts to be established in April 1998 (LVI students only, as UVI will be on exam leave)

- Field work/interviews in Oct/Nov/Dec 1998.
- Distillation/interpretation Dec/Xmas Vac/Jan/Feb/Mar.
- Begin writing up in January 1999.
- Survey completed and collected in at time of school visits.

Hand in Date: Wednesday 25th February 1998

Keith Atkinson

2201 words

INITIAL REFERENCES for Research Investigation Proposal

KEY: WOS = Ways of Seeing, MOC = Management of Change, RM = Research Methods in a Dynamic Context, C&I = Coherence and Integration, RIP = Research Investigation Proposal

Author(s)	Year	Title/Journal	Publisher/Volume	Page Ref.	Location
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Ball, S.	(1997)	"Good School/Bad School: paradox & Fabrication" British Journal of Sociology of Education	Volume 18, No. 3	pp. 317-336	RIP
Bell, J	(1993)	Doing your research project	OUP: Buckingham		RIP
Blake, N.	(1997)	"Research, Development and Tacit Capability in the Education System" Cambridge Journal of Education	Volume 27, No. 2	pp. 223-234	RIP, RM, C&I
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Bruner, J.	(1966)	Learning about Learning: A Conference Report	US Govt.: Washington	pp. 71-83 & pp. 196-211	RIP
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Bruner, J. & Haste, H. (Eds)	(1987)	Making Sense: The Child's Construction of the World	Methuen: London	Ch. 4 pp. 81-96	RIP
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Burghes, D. (et al)	(1996)	"The Interface between maths and d&t in secondary schools" The Curriculum Journal	Volume 7, No.1	pp. 35-50	RIP, C&I

Chiswell, C.	(1995)	"How is Action Research Helping to Develop My Role as a Communicator" <u>British Educational Research Journal</u>	Volume 21 No. 3	pp. 413-420	RIP
Chitty, C. (et al)	(1994)	"Specialisation and choice in Urban Education: the City Technology College experiment" <u>British Journal of Sociology of Education</u>	Volume 15, No. 3	pp. 409-421	RIP
Cohen, L. and Manion, L.	(1981)	<u>Perspectives on Classrooms and Schools</u>	Holt: London		RIP
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Cross, N. Ed	(1974)	<u>Man-Made Futures</u>	OUP: London		RIP
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Jones, L. & Jones, L. P.	(1992)	"Spiralling upwards: progression across the interface" British Journal of Curriculum & Assessment	Volume 3, No. 2	pp. 10-13	RIP
Kay, C.	(1994)	"A curriculum for the 21st Century?" British Journal of Curriculum & Assessment	Volume 5, No. 1	pp. 39-41	RIP
Kniveton, B.	(1996)	"Does Group Working Improve Boys' Performance in a Class Learning Task?" Curriculum	Volume 17, No. 2	pp. 94-101	RIP
Kyriacou, P & Wilkins, M.	(1993)	"The impact of the National Curriculum on teaching methods at a secondary school" Educational Research	Volume 35, No. 3	pp. 270-275	RIP
Lewis, A.	(1992)	"Group Child Interviews as a Research Tool" British Educational Research Journal	Volume 18, No. 4	pp. 413-422	RIP
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McAllister, W.	(1995)	"Are Pupils Equipped for Group Work without Training or Instruction?" British Educational Research Journal	Volume 21, No. 3	pp. 395-404	RIP
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O Duill, M.	(1997)	"Towards a relevant curriculum: initiating the third representational phase" British Journal of Curriculum & Assessment	Volume 7, No. 3	pp. 30-33	RIP
Pacey, A.	(1983)	The Culture of Technology	MIT: Massachusetts		RIP
Paechter, C.	(1995)	"Subcultural Retreat: negotiating the design and technology curriculum" British Educational Research Journal	Volume 21, No. 1	pp. 75-88	RIP
Perry, M. & Elder, D.	(1997)	"Knowledge in Transition: Adults' Developing Understanding of a Principle of Physical Causality" Cognitive Development	Volume 12, No. 1	pp. 131-157	RIP
Pike, S.	(1995)	"Supporting students in managing their own learning 14-19" British Journal of Curriculum & Assessment	Volume 5, No.3	pp. 37-43	RIP
Robson, C.	(1993)	Real World Research	Blackwell: Oxford		RIP & RM
Semper, E. et al	(1976)	Hidden Factors in Technological Change	Pergamon: Oxford		RIP
Siegler, R.	(1997)	"Beyond Competence-Toward Development" Cognitive Development	Volume 12, No. 3	pp. 323-331	RIP
Smithers, A.	(1994)	"The paradox of A levels" The Curriculum Journal	Volume 5, No. 3	pp. 355-364	RIP
Wellington, J.	(1994)	"How far should the post-16 curriculum be determined by the needs of employers?" The Curriculum Journal	Volume 5, No. 3	pp. 307-321	RIP
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THE NOTTINGHAM TRENT UNIVERSITY

DOCTORATE IN EDUCATION

COHERENCE & INTEGRATION REPORT - YR III

APPENDIX 4

- PLAN OF ORIGINAL SHAPE OF RESEARCH INVESTIGATION -

JULY 1999

KEITH ATKINSON

Overall Structure of the Investigation ~ 4/7/99

- **Abstract**

- **Introduction ~ Key Concepts**
  - Relationship between the 'Taught Modules' and the 'Investigation'.
  - Brief discussion of professional 'journey' to date in relationship to the Ed.D.
  - The aims of this Investigation
  - Commentary and sharpening up of the research question ~ plus associated emergent 'themes'.
  - The process of research (including an aetiology of methodology)
  - A consideration of values and ethics.
  - Conclusive remarks on dissemination.

- **Contextual Issues**
  - Blend in a discussion of my own professional context with a resume of the recent developments in D&T education as it relates to this specific Investigation.
  - Discussion of emergent themes (as related to 1.3.8 - 1.3.10):
    - Thinking, learning and teaching
    - Progression. The interplay between progression and assessment. The roles of atomised and holistic assessment.

- **Capability**
  - **N.B.** This is a really 'meaty bit' of the Investigation. It relates to 1.3.7.
    - This discussion will be partly shaped by cycle1 and cycle2 of the Action Research. (It is difficult to be more specific at this stage.)
    - Epistemological discussions of 'the literature':
      - Schön ~ embedded knowledge (Reflective Practitioner).
      - Stephenson ~ HEFC movement.
      - Discussion of possible effects of rural and suburban contexts on capability.
      - Review of the literature (to clarify), with an international overview:
        - NCC, SCAA, QCA ~ 'Capability' in England and Wales (Process approach). (Including RB's recent QCA document.)
        - TFAA ~ 'Technological Literacy' in USA (Content approach)
        - The French and Australian dimensions.
        - Design & Technology education, managing change and my doctoral journey.

- **Methodology**
  - Further discussion of why Action Research ~ extension of section 1.4
  - A description of the reconnaissance.
  - My research design ~ the thinking behind, and development of, my 'lumpy and messy' methods.
  - What I actually did:
    - The choice of schools, plus pertinent details.
    - Cycle 1 ~ Discussion and the survey/questionnaire. More reading and reflection.
    - Cycle 2 ~ Recorded interviews with participants (Staff and Students). More reflection and reading.
    - Probably no third cycle due to timescale?
  - Accruing the data.
  - Analysing the data
  - Data reduction (occurs throughout the project - see Miles & Huberman (1994, p.10).

- **Analysis**
  - Make explicit my own values - see McNiff (1996, p.40).
  - Make explicit the contextual issues, as relating to the interpretation of analysis.
    - The schools in which I conducted the research.
    - Issues surrounding the interplay between the various aspects of the Ed.D. course.

- **Findings**
  - Reflect upon what the data appears to be 'saying' to <u>myself</u> as unique individual and practitioner-researcher.
  - Consider validatory issues ~ *vis-a-vis* the data - see McNiff (Op. Cit., pp.24-27).

- **Conclusions**
  - Any conclusions that I feel able to draw from the research process.
  - Any conclusions that I feel able to draw from the analysis of data.
  - Factors affecting my interpretation of the data.
  - Issues pertinent to the end of the doctoral journey. Overall perspective.
  - This work as gateway for a larger piece of work.

- **Bibliography**

- **Appendices**

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APPENDIX 5

- COPIES OF ORIGINAL PLATFORMS OF BELIEF -

JULY 1999

KEITH ATKINSON

Platform of Educational Beliefs - Keith Atkinson - Doctorate in Education Yr. 1

I am completely committed to the idea of truly comprehensive education, in which the needs of individuals and the requirements of a living learning community are reconciled and focused into providing high quality, challenging and rigorous experiences for <u>all</u> pupils.

Encouraging teamwork in pupils, via active participation in the curriculum (technology) and extra curricular activities (outdoor pursuits), and in staff, via the provision of a clear sense of purpose and the generation of enthusiasm borne out of sharply focused target setting and genuine participation in decision making, underpins my vision of what a successful school should be. This vision leads me to strive for the pupil goals of success and achievement through the acknowledgement of effort in giving praise and positive reinforcement, full and active participation in the life of the school and its community and becoming well qualified, articulate and creative individuals.

As a learning institution the school must continually seek to develop and enhance an environment in which individual confidence and a sense of belonging flourish, where expectations are high and where self discipline and hard work are accepted as the norm. Education is at its most imaginative when utilising a wide range of teaching and learning styles; active learning through 'hands on' experiences create a vibrancy which can, in instances of best practice, resonate across the whole curriculum and permeate all learning experiences, including pastoral and extra curricular activities. Out of such an environment the full development of each pupil's potential is of prime concern.

An ability to build and maintain sound relationships which utilise personal qualities such as honesty, integrity and simplicity are central to a pupil's holistic development. A successful learning community has its academic excellence measured by good examination results and recognises future needs and aspirations as well as acknowledging sporting, musical, artistic, creative and expressive achievements.

The curriculum, in its development, management and delivery, must recognise the learning community as a confederation of individuals. The school curriculum, in its broadest sense, must be:

- Broad - reflecting the diversity of human activity.
- Balanced - giving due regard to all aspects of learning.
- Relevant - to present and future needs of the developing person.
- Coherent - all parts are in harmony with each other.
- Accessible - learners can avail themselves of all areas and are sufficiently challenged

My experiences in four schools have taught me that the nature of the curriculum and its organisation, the teaching and learning strategies adopted, the assessment and reporting procedures and the setting of targets and monitoring of performance must reflect the school's commitment to provide genuinely comprehensive education. The model I have outlined above seeks to expedite this in an efficient and fulsome manner.

Personal experience allows me to suggest that high quality leadership and good school management are concerned with people. This must always be the main priority. Support, encouragement, appreciation and involvement are all important in effective management, mainly achieved through participation by involving colleagues in the sharing of understanding and ownership of decisions. Other facets which overarch my management philosophy include openness, discussion and co-operation, all of which contribute to a school which exhibits a strong unity of purpose and coherence.

Appendix 6.2

Audience Comments
From
Seminar Presentation

K.A.

Introduction: Does it set the scene? Does it help with understanding the objectives, aims: i.e. it is clear what the presenter is trying to do?

Any comments? good comments about values being underplayed
Very clear.

Resources: Can you read them? Do they add to the presentation? Do they help get over the point? Do they do the job? Do they fit this audience?

Any comments? I really got distracted by the spaghetti cycles. Neat OHT's. Good for all elements of the audience – we all had a different perspective/interest/starting point.

Communication: Is there rapport with the audience? Is it engaging, interesting? Is it good as an oral communication? Can the audience see the issues as the presenter sees them (even if they don't agree with the presenter's views)?

Any comments? Very lively, interesting & personable. It communicated well – even the awful jokes.

Overall shape and context: Has it set the context of beliefs, values, and the professional background of the presenter? Is it informed? Is there recognition of the complexity of, and questions arising from, the content? Is there a clear logic / flow / structure?

Any comments? Really big emergent themes. Teaching, learning, thinking, knowledge(!) How will you cope?!
A good structure & flow – clear introduction to the complexity of the subject and questions and questions

....

I liked: everything except the jokes.

I would have preferred: More time on the analysis, so that we could have engaged in discussion

I would have liked: better jokes

The following ideas or thoughts will help me with my own practice: your comments about defining technological capability

Signed MHayes.

Introduction: Does it set the scene? Does it help with understanding the objectives, aims: i.e. it is clear what the presenter is trying to do?

Any comments? Yes, very helpful

Resources: Can you read them? Do they add to the presentation? Do they help get over the point? Do they do the job? Do they fit this audience?

Any comments?
Yes they were fine, but myself I like fewer OHPs. Loved the handout

Communication: Is there rapport with the audience? Is it engaging , interesting? Is it good as an oral communication? Can the audience see the issues as the presenter sees them (even if they don't agree with the presenter's views)?

Any comments?
This was really, really good - I found myself drawn in right the way through. It was hard not to be able to join in!

Overall shape and context: Has it set the context of beliefs, values, and the professional background of the presenter? Is it informed? Is there recognition of the complexity of, and questions arising from, the content? Is there a clear logic / flow / structure?

Any comments?
It was very ambitious in scope, but you managed it: there were a lot of ideas in a short time
....

I liked:

That jokes
The interaction with the audience
The seriousness of the underlying points you were making.

I would have preferred:

Fewer overheads

I would have liked:

Time for questions! But this is not your fault, rather a commentator - as I said above

The following ideas or thoughts will help me with my own practice:

The life-story as you plotted it against your own ideas & questions, and in relation to the DocEd - the thinking about influence at the moment, in my own work.

Signed

Mo Griffiths

Thanks!

Keith

***Introduction*:** Does it set the scene? Does it help with understanding the objectives, aims: i.e. it is clear what the presenter is trying to do?
Any comments? yes.

***Resources*:** Can you read them? Do they add to the presentation? Do they help get over the point? Do they do the job? Do they fit this audience?
Any comments? yes

***Communication*:** Is there rapport with the audience? Is it engaging, interesting? Is it good as an oral communication? Can the audience see the issues as the presenter sees them (even if they don't agree with the presenter's views)? yes.
Any comments?

Overall shape and context: Has it set the context of beliefs, values, and the professional background of the presenter? Is it informed? Is there recognition of the complexity of, and questions arising from, the content? Is there a clear logic / flow / structure? yes.
Any comments?

....

I liked:

Good clear overhead slides. Easy to read. Good rapport with audience.

I would have preferred:

I would have liked:

The following ideas or thoughts will help me with my own practice:

Signed

Eileen Ryan (Mike's wife).

Venter

***Introduction*:** Does it set the scene? Does it help with understanding the objectives, aims: i.e. it is clear what the presenter is trying to do?

Any comments? Yes. Set with humour and clarity

***Resources*:** Can you read them? Do they add to the presentation? Do they help get over the point? Do they do the job? Do they fit this audience?

Any comments? Resources v.g.

***Communication*:** Is there rapport with the audience? Is it engaging, interesting? Is it good as an oral communication? Can the audience see the issues as the presenter sees them (even if they don't agree with the presenter's views)?

Any comments? Excellent communication skills — lively, with momentum + varied

Overall shape and context: Has it set the context of beliefs, values, and the professional background of the presenter? Is it informed? Is there recognition of the complexity of, and questions arising from, the content? Is there a clear logic / flow / structure?

Any comments? Recognition of complexity, yes, but the 'core' did not receive sufficient emphasis

....

I liked: The manner of the presentation — very engaging.

I would have preferred: — more time for your presentation! More time within the presentation on the concept of technology and on the thinking behind the instrument — and its development

I would have liked:

— As above, really — I want to know more about the core issues in your examination of 'technology capability'. I don't feel I know what views you came to on this.

The following ideas or thoughts will help me with my own practice:

1/ Using cartoons in presentation

2/. The method provided by the union of the personal + substantive.

Signed [signature]

Introduction: Does it set the scene? Does it help with understanding the objectives, aims: i.e. it is clear what the presenter is trying to do?

Any comments?

Yes. There were very clear signposts given.

Resources: Can you read them? Do they add to the presentation? Do they help get over the point? Do they do the job? Do they fit this audience?

Any comments?

The OHTs were clear and used effectively. I enjoyed the humo

Communication: Is there rapport with the audience? Is it engaging , interesting? Is it good as an oral communication? Can the audience see the issues as the presenter sees them (even if they don't agree with the presenter's views)?

Any comments?

Absolutely! I thought this aspect of the presentation was excellent

Overall shape and context: Has it set the context of beliefs, values, and the professional background of the presenter? Is it informed? Is there recognition of the complexity of, and questions arising from, the content? Is there a clear logic / flow / structure?

Any comments?

The context was explained very clearly

....

I liked: The clear context, the engaging style of delivery, the evident enthusiasm and the humour

I would have preferred:

Time to look carefully at the document; but I realise that wasn't possible within our constraints

I would have liked: To have been shown a little more clearly how the tentative findings related to the original question

The following ideas or thoughts will help me with my own practice:

Some of the ideas on context will be v. useful.

__Signed__ Sue Wallace.

Keith

Introduction: Does it set the scene? Does it help with understanding the objectives, aims: i.e. it is clear what the presenter is trying to do?

Any comments?

I thought it very explicit. Aims clear

Resources: Can you read them? Do they add to the presentation? Do they help get over the point? Do they do the job? Do they fit this audience?

Any comments? I thought they were used judiciously.

Communication: Is there rapport with the audience? Is it engaging, interesting? Is it good as an oral communication? Can the audience see the issues as the presenter sees them (even if they don't agree with the presenter's views)?

Any comments? Good open presentation. Being an 'insider' to technology, I have the advantage of knowing his field and questions

Overall shape and context: Has it set the context of beliefs, values, and the professional background of the presenter? Is it informed? Is there recognition of the complexity of, and questions arising from, the content? Is there a clear logic / flow / structure?

Any comments? Structure sound. His motivations clear. I would have liked some indication of preliminary findings - more/[illegible]

I liked:

The pace of the presentation. The energy and enthusiasm. The frankness of his knowledge deficits; the clear OHTs; the intention to grapple with fundamental issues

I would have preferred:

To hear some early indications of analysis in response to the research question.

I would have liked:

To hear more about how Keith's own history influenced the study

The following ideas or thoughts will help me with my own practice:

- Action research cycles.
- Historical perspective
-

Signed [signature]

Keith.

Introduction: Does it set the scene? Does it help with understanding the objectives, aims: i.e. it is clear what the presenter is trying to do?

Any comments? Good scene set - especially putting "thoughts" in context of personal experience

Resources: Can you read them? Do they add to the presentation? Do they help get over the point? Do they do the job? Do they fit this audience?

Any comments? Very engaging, clearly presented to the audience. Explained keith's "work in progress"

Communication: Is there rapport with the audience? Is it engaging , interesting? Is it good as an oral communication? Can the audience see the issues as the presenter sees them (even if they don't agree with the presenter's views)?

Any comments? Good rapport. Enjoyed interplay of cartoon and subject matter.

Overall shape and context: Has it set the context of beliefs, values, and the professional background of the presenter? Is it informed? Is there recognition of the complexity of, and questions arising from, the content? Is there a clear logic / flow / structure?

Any comments? Yes - a good structure and clear flow.

....

I liked: Format of Presentation and structure of your research.

I would have preferred:

More information on how you put the types of questions etc. together on the

I would have liked: questionnaire - criteria for them etc

The following ideas or thoughts will help me with my own practice:

Signed Mary Hague.

Introduction: Does it set the scene? Does it help with understanding the objectives, aims: i.e. it is clear what the presenter is trying to do?

Any comments? Engaging, crisp & enthusiastic start good balance of humour + pertinent views.

Resources: Can you read them? Do they add to the presentation? Do they help get over the point? Do they do the job? Do they fit this audience?

Any comments?

Communication: Is there rapport with the audience? Is it engaging , interesting? Is it good as an oral communication? Can the audience see the issues as the presenter sees them (even if they don't agree with the presenter's views)?

Any comments?

Overall shape and context: Has it set the context of beliefs, values, and the professional background of the presenter? Is it informed? Is there recognition of the complexity of, and questions arising from, the content? Is there a clear logic / flow / structure?

Any comments?

....

I liked: Very enthusiastic + determined pace of the presentation.
The injection of humour at key points ensured the audience "remained with you"; plus made

I would have preferred: Sure your introduction was enthusiastic (both audience + speaker).

This is tricky!
I enjoyed the presentation immensely and would have been proud to have delivered this myself. (I am not being a creep!!).

I would have liked:

N/A.

The following ideas or thoughts will help me with my own practice:

Maintain your enthusiasm and determination – you will succeed.
Your research + delivery methods are excellent.

Signed

B. G[illegible]

***Introduction*:** Does it set the scene? Does it help with understanding the objectives, aims: i.e. it is clear what the presenter is trying to do? Not sure.

Yes. *Any comments?*

Relaxed setting

***Resources*:** Can you read them? Do they add to the presentation? Do they help get over the point? Do they do the job? Do they fit this audience?

Y *Any comments?* Y Y

Good. Keep attention on track

***Communication*:** Is there rapport with the audience? Is it engaging, interesting? Is it good as an oral communication? Can the audience see the issues as the presenter sees them (even if they don't agree with the presenter's views)? ← presenters views a

Y *Any comments?*

bit rushed due to time contraints.

Overall shape and context: Has it set the context of beliefs, values, and the professional background of the presenter? Is it informed? Is there recognition of the complexity of, and questions arising from, the content? Is there a clear logic / flow / structure? Y

Y. *Any comments?*

....

I liked: OHT to keep on track

light hearted bits - could get very dry otherwise especially for those outside the group for whom the language is not day to day.

I would have preferred:

A few more minutes to gather knowledge of findings.

I would have liked:

To understand all the big words although they were well explained.

The following ideas or thoughts will help me with my own practice:

Signed J Atkinson.

***Introduction*:** Does it set the scene? Does it help with understanding the objectives, aims: i.e. it is clear what the presenter is trying to do?

Any comments?

***Resources*:** Can you read them? Do they add to the presentation? Do they help get over the point? Do they do the job? Do they fit this audience?

Any comments?

***Communication*:** Is there rapport with the audience? Is it engaging , interesting? Is it good as an oral communication? Can the audience see the issues as the presenter sees them (even if they don't agree with the presenter's views)?

Any comments?

Overall shape and context: Has it set the context of beliefs, values, and the professional background of the presenter? Is it informed? Is there recognition of the complexity of, and questions arising from, the content? Is there a clear logic / flow / structure?

Any comments?

....

I liked: The introduction related course to professional practice & personal development. The personal insight added depth to both Keith's view of D&T & Keith's engagement with the course.

I would have preferred:

I would have liked:
An idea of the overall aim of the investigation & its contribution in the field of D&T.

The following ideas or thoughts will help me with my own practice:
Where do I ultimately want to go with the long study?
Who do I want to influence?
What are the gaps in the current literature?
What are the 'key' issues regarding Technology/Transfer and the role of TNTU?
How will this work influence my current & future professional practice.

<u>Signed</u>
Rachelle Maxwell

DICE.
Doc. Ed. 26.5.99.

Introduction: Does it set the scene? Does it help with understanding the objectives, aims: i.e. it is clear what the presenter is trying to do?

Any comments?

Resources: Can you read them? Do they add to the presentation? Do they help get over the point? Do they do the job? Do they fit this audience?

Any comments?

Communication: Is there rapport with the audience? Is it engaging , interesting? Is it good as an oral communication? Can the audience see the issues as the presenter sees them (even if they don't agree with the presenter's views)?

Any comments?

Overall shape and context: Has it set the context of beliefs, values, and the professional background of the presenter? Is it informed? Is there recognition of the complexity of, and questions arising from, the content? Is there a clear logic / flow / structure?

Any comments?

Keith

I liked: Good rapport. Clear layout & flow. Resources easy to read (black background a bit gloomy!)

I would have preferred: N/A Comprehensive coverage of own position & wider issues

I would have liked:

The following ideas or thoughts will help me with my own practice:

Role of context → links to similar themes in competence.

Need to focus clearly → not be distracted by emerging ideas.

Signed

Mike

Keith.

Introduction: Does it set the scene? Does it help with understanding the objectives, aims: i.e. it is clear what the presenter is trying to do?
Any comments?
Your personal reflections are very clear and strong + influential

Resources: Can you read them? Do they add to the presentation? Do they help get over the point? Do they do the job? Do they fit this audience?
Any comments?
All useful - except 'tentative analysis' which was a bit small for me

Communication: Is there rapport with the audience? Is it engaging ,, interesting? Is it good as an oral communication? Can the audience see the issues as the presenter sees them (even if they don't agree with the presenter's views)?
Any comments?
Very enjoyable, 'context' is important in my own work too.

Overall shape and context: Has it set the context of beliefs, values, and the professional background of the presenter? Is it informed? Is there recognition of the complexity of, and questions arising from, the content? Is there a clear logic / flow / structure?
Any comments? Very clear, but what are some of the issues arising

....

I liked:
Your layout

I would have preferred:
If you had 10 more minutes to do full justice to your

I would have liked:

The following ideas or thoughts will help me with my own practice:

The search for true meanings
The importance of contextuality
I agree that the more you think you know the less you find you do!

Signed Jenna. 26.5.99

Keith Atkinson

Introduction: Does it set the scene? Does it help with understanding the objectives, aims: i.e. it is clear what the presenter is trying to do?

Any comments? Clear overview of the presentation. Well structured.

Resources: Can you read them? Do they add to the presentation? Do they help get over the point? Do they do the job? Do they fit this audience?

Any comments? Nice use of humour to make points

Communication: Is there rapport with the audience? Is it engaging , interesting? Is it good as an oral communication? Can the audience see the issues as the presenter sees them (even if they don't agree with the presenter's views)?

Any comments? Effective ~~communication~~ of the key ideas in the research.

Overall shape and context: Has it set the context of beliefs, values, and the professional background of the presenter? Is it informed? Is there recognition of the complexity of, and questions arising from, the content? Is there a clear logic / flow / structure?

Any comments? Very well aware of the difficulties of the subject. Very 'well read' (I probably know this from our contacts)

I liked: The clear and well thought out structure of the presentation. The use of humour to add interest

I would have preferred:

Not much I can say here!!

I would have liked:

More time to explore some of the ideas in a Q&A with Keith. The opportunity to explore some of the data from the questionnaire

The following ideas or thoughts will help me with my own practice:

Breadth in thinking about the nature of technology and in particular 'technology adventure'

Signed R Bowen

Difficult for me not to see beyond what was presented to extrapolate from our previous contacts. Not sure how much of the above is based on this knowledge