# UNIVERSITY OF SOUTHAMPTON

FACULTY OF ENGINEERING, SCIENCE AND MATHEMATICS

School of Electronics and Computer Science


# Higher Education and Learning Technologies
# an Organisational Perspective


by

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Thesis for the degree of Doctor of Philosophy

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UNIVERSITY OF SOUTHAMPTON

ABSTRACT

FACULTY OF ENGINEERING, SCIENCE & MATHEMATICS

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Doctor of Philosophy

# Higher Education and Learning Technologies: An Organisational Perspective.

by Susan Ann White

The uptake and diffusion of the use of learning technologies in UK Higher Education is an instance of the adoption of change. There has been considerable research into the ways in which the uptake and diffusion of innovation can bring about change processes. This work has identified the importance of barriers and drivers to change as a part of the process. Areas of study have included general instances, those specific to technology and those relevant to the use of learning technology in higher education.

It has also been shown that a Higher Education institution's organisational structure may itself inhibit or constrain the way in which the institution can respond to external changes and adopt new practices. This study reviews the development and growth in the use of learning technologies. It sets these activities in the context of changes in computing in education and psychology from a UK and a US perspective.

The study analyses an extensive survey of the use of learning technology at the University of Southampton, suggesting that institutional approaches are associated with organisational models and may amplify or dampen the known barriers and drivers for change. A study of experiences across a range of UK Higher Education Institutions provides further evidence for this argument.

**CONTENTS**

# Chapter 1 Introduction and Context

**This chapter outlines the scope and motivation for this research. It identifies some of the issues which will be explored in depth in the rest of the thesis. It concludes by providing a brief summary of the aims of each subsequent chapter.**

The thesis examines the way in which learning technologies have been adopted and implemented in UK Higher Education Institutions.

- Learning Technologies are taken in their broadest sense to be the approaches to teaching which make use of computer technology in teaching and the support of student learning.

Higher Education Institutions are taken to be those institutions in the United Kingdom whose major activity is Higher Education as defined by the Higher Education Funding Council for England,

> *"Higher education courses are generally above the standard of GCE A-levels or National Vocational Qualification (NVQ) Level 3. They include degree courses, postgraduate courses and Higher National Diplomas".*
>
> (HEFCE, 2005b).

For the purpose of this study these are the publicly funded universities and colleges of higher education who are members of either Universities UK or the Standing College of Principals.

The thesis examines existing theories of change, particularly in the context of Higher Education. It assembles data from a set of studies drawn from Higher Education Institutions in the UK and considers the way in which institutions are organised. Greater detail relating to the studies is provided in Chapter Nine.

It then draws together these two strands of research to consider how the particular organisational structure of an institution may influence the uptake and usage of learning technologies. Institutions examined are used to typify different organisational structures.

The original motivation for this work arose from my participation in 'The Scholar Project', which was one of a family of projects experimenting with the use of learning technologies undertaken in the UK in the early 1990's. The set of projects were part of the UK-wide Teaching and Learning Technology Programme (HEFCE, 1996, Hall and White, 1997, White, 1997). The initiative came about because government and the Higher Education funding bodies were motivated to discover ways in which the "effectiveness and efficiency" of university teaching might be enhanced by the use of technology. The project in which I was involved particularly focussed on enabling and promoting an institution-wide impact of learning technologies, and came with the ambitious objectives of "shifting the culture to establish a campus wide structure for multimedia learning".

The Scholar Project was begun before the era of the World Wide Web, but came after more than thirty years of active academic interest and research into the use of computers in education. A particular perspective and strength in Electronics and Computer Science at the University of Southampton derived from research into text processing and hypertext which led to the development and use of the Microcosm open hypermedia system (Hall *et al.*, 1995, Hall *et al.*, 1996). Academics teaching at Southampton were also actively engaged in intensive research. The method for promoting the use of learning technologies which we took with the project was designed to work well in a research intensive environment. The projected develop an approach of resource based learning using hypermedia systems to knit together the diverse resources typically used to support university teaching.

Within the framework of the project it soon became clear that any successful tactic to encourage the use and development of learning technologies relied on a combination of inter-related inputs,

- developing the computer based learning resources;
- providing adequate supporting infrastructure such as equipment and technical support
- addressing issues of staff development and empowerment.

However, it was observed that, even if the development and use of individual pieces of learning technology were successful, that did not necessarily guarantee continued use, or the adoption of the successful approaches by other academic colleagues.

Whilst considering the possible reasons that learning technologies were not adopted on a wider scale across the university, I came across the work of Geoghegan who asked the question “Whatever Happened to Instructional Technology?” (Geoghegan, 1994b). He pointed out that despite its long history, the use of computers in education had not yet become commonplace. He drew extensively on previous work by Geoffrey Moore’s popular business book “Crossing the Chasm”. Moore’s theories were based on previous research into business innovation and his experience as a marketing consultant. From this perspective he analysed possible reasons for success or failure of technology in the ‘Sunrise Industries’ in the US (Moore, 1991). It seemed to me, from the perspective of someone working to embed a learning technology project into an institution and achieve widespread adoption of technology, that Geoghegan’s observations had great relevance to the problems the project was facing on a daily basis.

In addition, in the UK, Ian McNay had made some interesting observations concerning the organisational culture of universities, and the impact this had on the way in which they could embrace change (McNay, 1995).

Impressed by these two perspectives both of which seemed relevant to my work, I wondered if there was some way in which they might be drawn together to offer additional insight into the factors influencing the use and uptake of learning technologies in UK higher education.

Initially, in order to gain some measure of its impact, the Scholar Project had collected and analysed data from university staff at Southampton reflecting their attitudes to and use of technology in and around their work in teaching and the support of learning (Barnett *et al.*, 1998). Amongst other things it identified that academic staffs’ perceived a number of barriers to adopting new methods for teaching. This data will be analysed extensively in Chapter Eight ‘Attitudes: the Academics’ Perspective’. I was also curious to explore the arguments put forward by Geoghegan, Moore and McNay to see if I could identify a theoretical framework from

within their ideas which might throw light on the issues associated with achieving change which I was experiencing through my work on the Scholar Project.

This thesis sets out to a) define the theoretical framework which I identified within these different pieces of work and b) to offer evidence which sustains this theory. It looks specifically at a set of inter-relationships set around four factors:

- (The) Organisation
  Higher Education incorporating the joint endeavours of research and teaching

- Structure
  The way in which Higher Education Institutions are structured and the processes and mechanisms they use to manage what they do

- Culture
  The institution-wide sets of values and beliefs which result from the organisation and its activities – specifically in this case the culture produced by research and teaching in Higher Education

- Climate
  The specific motivators or constraints perceived by individuals within an organisation

By analysing a mixture of quantitative and qualitative data collected for the thesis I will seek to demonstrate the value of analysing and understanding an institutions broad organisational approach. I will go on to show how this analysis and understanding may be used to predict how an institution is likely to experience and respond to technological change in an educational context.

I explain how an understanding of the organisation of an institution can be used to identify or predict the likely distribution of potential 'early adopter', 'early majority' and 'late majority' users of learning technologies. Each of these categories of users has different responses to the introduction and use of new technology. Each type of user also has different specific needs which need to be met before they will adopt technological innovations. Identifying and analysing the mix of user types, and understanding their needs, can be used as a shortcut to determine which methods,

employed in the introduction and support of technology, will be most conducive to the success of that process.

Chapter Two outlines in broad terms the research methodology adopted by the study. It shows how the need to understand the complex inter-relationship of organisational factors and technological capabilities led to the mixed methods approach to research adopted during the development of the thesis, and explains how this approach is particularly appropriate to the analysis of cultural issues associated with organisational change.

Chapter Three examines the general development of the use of technology for learning and teaching. The chapter examines the history of learning technologies from a technological perspective it then looks at the specific context of this thesis through experience in the UK particularly in the period running up to and during the time of the study. Chapter Four continues this analysis by drawing together developments of technology and education to outline the way in which important technology affordances have emerged and been championed through widespread use.

Chapter Five. examines ways in which different technologies can be categorised, and further explores the affordances of particular technological implementations. Chapter Six examines theories of change and innovation. It begins to relate these theories to ways in which institutions have gone about the introduction and use of learning technologies in Higher Education.

The final chapters are concerned with the analysis of institutional data. Chapter Eight presents the attitude and usage data collected at Southampton over almost ten years by the Scholar Project and begins to analyse it in the context of the theories of change and technological implementation. Chapter Nine presents data collected in a series of interviews at six English Universities. Chapter Ten presents conclusions drawn from the research and identifies useful areas for possible future research.

# Chapter 2 Research Methodology

**This chapter summarises the research methods used in the construction of the thesis. It presents the rationale underlying the approach adopted. It explains the context in which the research was begun. It then outlines the way in which sources of quantitative and qualitative data has been identified and collected. Finally it explains how they will be used together in a mixed method approach.**

## 2.1 Context

As was explained in the introduction, the beginnings of the research undertaken in this thesis came from work undertaken by the author with the UK Teaching and Learning Technology Programme "Scholar Project" (Maier and White, 1994, HEFCE, 1996). It was subsequently developed during work with the UK Teaching and Learning Technology Support Network (Tucker, 1996, HEFCE, 1998a).

### 2.1.1 Some Research Questions

The initial research question was

**How does organisation effect the uptake and use of learning technologies?**

The question was the outcome of reflections on the routine problems faced when trying to address the objectives of the two Teaching and Learning Technology initiatives. Further analysis was applied taking the introduction and use of learning technology into UK Higher Education as a particular instance of organisational change. This resulted in a set of further subsidiary questions.

- How can we identify drivers and barriers to change?
- Do beliefs and attitudes of individuals affect an organisation's ability to embrace change?
- Do different organisational cultures accelerate or inhibit affect an organisations ability to embrace change?
- What is the relationship between an organisational structure, culture and climate, and how does this relate to the ability to embrace change?

- Do universities where teaching is a major activity have different organisational structures, cultures and climates from universities where research predominates?

### 2.1.2 Organisation, Structure, Culture, Climate

Together the initial questions were coalesced into the following:

- Are there inter-relationships between organisational mission, structure, culture and climate?
- How can we identify these inter-relationships?
- Would an understanding of these possible relationships help understanding of how to initiate and support change?

Factors under consideration can be summarised in the diagram (Figure 1) below

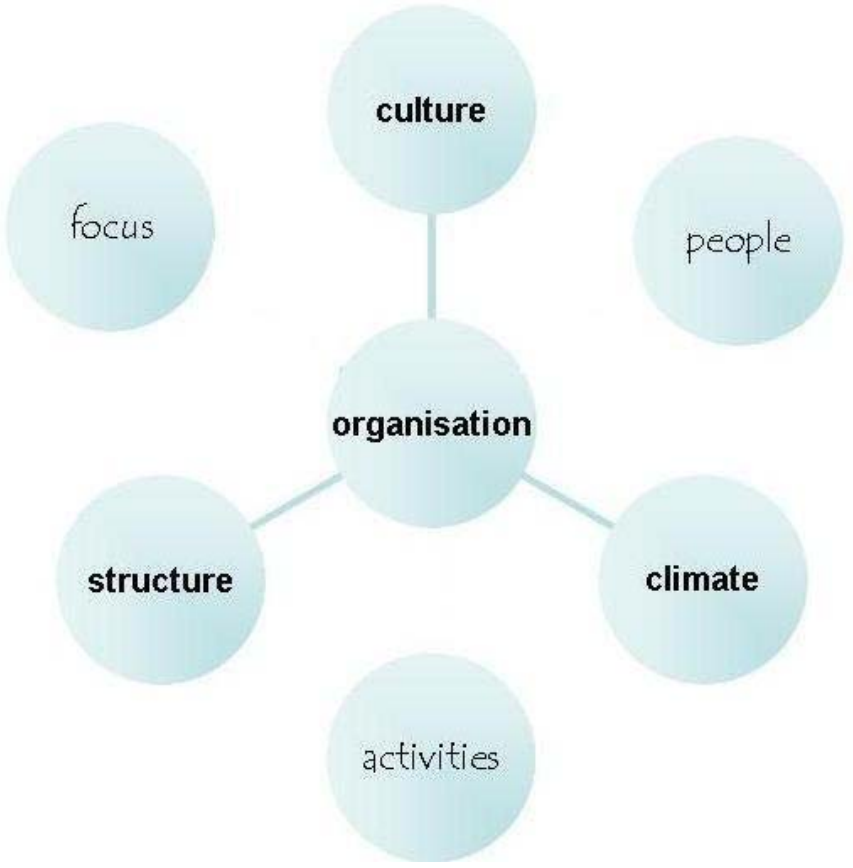



**Figure 1. Key Factors which may Impact upon Organisational Change**

A further more detailed account of the components of organisation change as they relate to organisation, structure culture and climate is summarised in the concept map shown below (Figure 2).

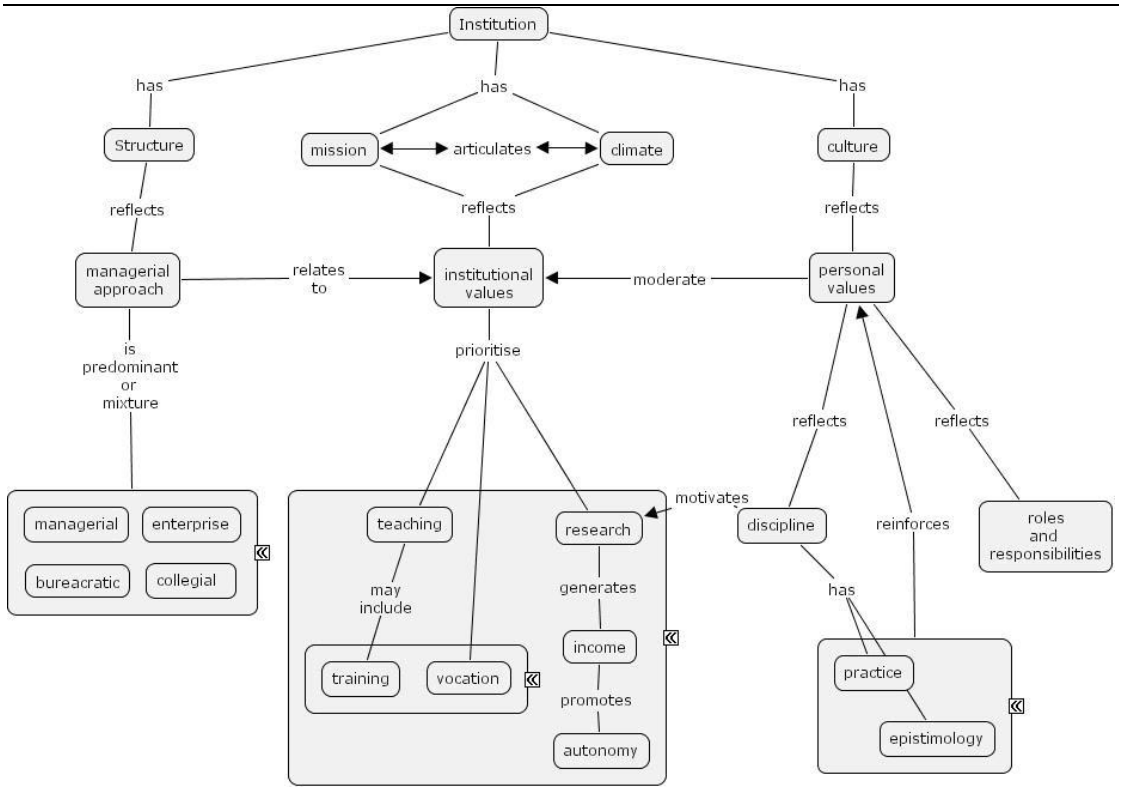



**Figure 2. Concept Map Exploring the Relationship between Organisation Structure Culture and Climate**

## 2.1.3 Individual approaches to learning technologies

It was observed that the approaches adopted by staff were dependent upon a whole range of factors including supporting infrastructure (physical and human), prevalent understanding of educations methods, and the available learning technology (both hardware and software). This can be considered as a cycle of interdependent factors as shown below (Figure 3)

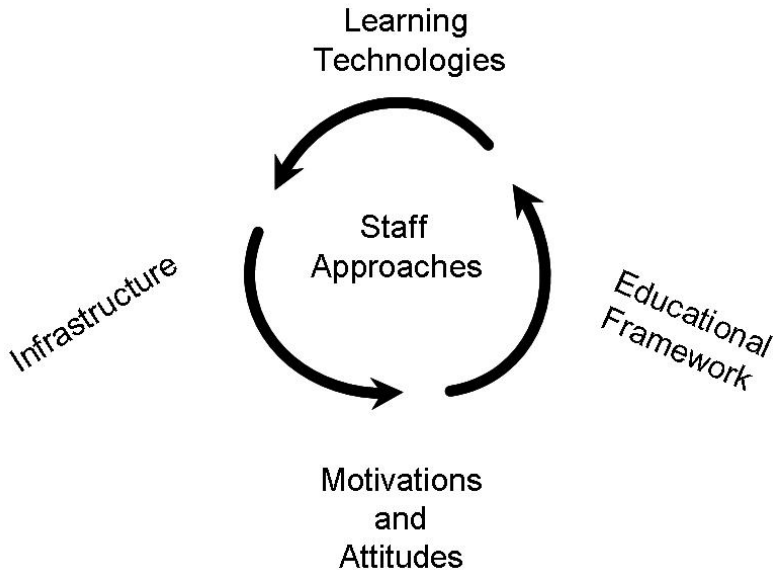



**Figure 3. Cyclical diagram showing factors which may influence an academics approach to learning technologies**

Another way of considering these factors is from the perspective of an individual academic. Individuals will take differing approaches to the use of learning technologies. These approaches will be determined by a combination of their experience and understanding of a set of factors. This possible model is summarised as shown (Figure 4) below.

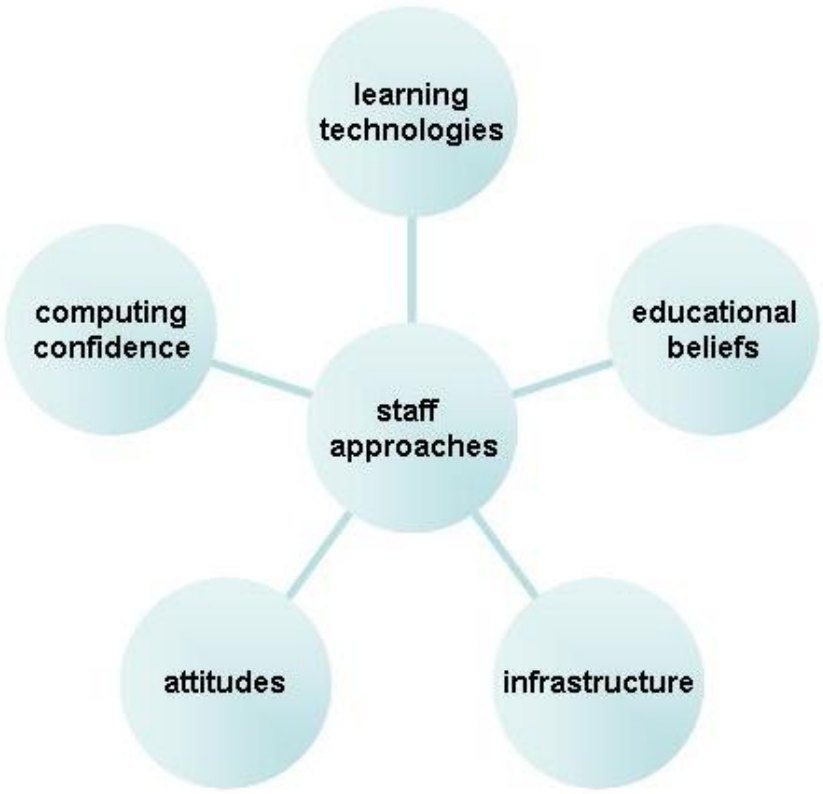



**Figure 4. Key Factors which may Impact upon Organisational Change**

The inductive analysis summarised above highlighted the need to study, analyse and understand social processes of universities, and signified the appropriateness of a qualitative methodology. Denison argues that such studies must necessarily be observational and naturalistic rather than experimental (Denison, 1996).

The questions which arose in trying to evaluate the importance of possible relationships suggested by the analysis were explored with interview subjects and are considered and analysed in detail in Chapter Nine 'Experience: The Institutional Perspective'. It also prompted consideration of some possible theoretical frameworks outlined in Chapter Seven 'Change and Innovation'.

## 2.2 Observational and Naturalistic Methods

Following through Denison's observation and looking at existing studies of organisations and higher education an ethnographic approach seemed appropriate.

Although some might argue that ethnography is concerned with close field observation, research in an educational context often uses an ethnographic approach which effects the observation through less anthropological methods (Wolcott, 1979).

### 2.2.1 Using Ethnography

According to one observer, ethnography is concerned with "the meaning of actions and events to the people we seek to understand" (Spradley, 1979). In the case of this study, the people we seek to understand are the 'actors' in the organisation which is a higher education institution. The 'events' are the uptake and use of learning technologies. An ethnographic approach employs observation and systematic analysis (Wolcott, 1979, Ellen, 1984, Wolcott, 1990, Grills, 1998, Bishop, 1999). If the theoretical models outlined above were to be explored and tested then it appeared that an ethnographic approach might be appropriate – at least for some part of the data collection.

## 2.3 Quantitative Data

Although the analysis above suggests that an ethnographic approach should be adopted, substantial amount of quantitative data was also available.

Some quantitative data which contributes to this study was derived during the original Scholar Project which was concerned with establishing campus wide use of multimedia. The Project's method was to work with a wide range of discipline based mini projects across the university. These projects were to act as proof of concept and exemplars of the use of learning technologies to academics across the university. The objective of this activity was to attain a wider uptake and use of learning technologies in teaching. The project also sought to support the use of technologies in such a way as to embed them into teaching practice. For this reason it was important to collect data which measured the (then) current use of learning technologies, and track this use over time.

Because the project was concerned with motivating change on campus, one activity of the project investigated academics' attitudes and experiences of the use of learning technologies. This prompted the collection of two sets of data looking at academics use of technology, and their associated skills.

Since the project was also interested to see if a shift in attitudes had occurred across the duration of the project, the work included the collection and analysis qualitative data. Since the project had collected a large volume of data the author ran the questionnaire for a third time in 1997. The questionnaire used for this part of the study is found in Appendix A and the data is analysed in detail in Chapter Eight 'Attitudes: The Academic Perspective'.

## 2.4 Qualitative Data

Alongside the qualitative data collected with The Scholar Project questionnaires, the additional research questions outlined in section 2.1 (above) motivated the collection of additional qualitative data. The latter part of the thesis uses this data gathered during a series of interviews with key players at a range of UK Universities during 2004 and 2005. Data was collected from five different Higher Education Institutions, This recent part of the research takes a case study approach after Yin (Yin, 2003b, 2003a, 2004).

> *"The goal is to practice sound research while capturing both a phenomenon (the real-life event) and its context (the natural setting). One strength of the case study method is its usefulness when phenomenon and context are not readily separable, a condition that occurs in real-life but cannot easily be duplicated by laboratory research. Another strength is that the method [addresses] "how" and "why" questions about the real-life events, using a broad variety of empirical tools (e.g., direct field observations, extended interviews, and reviews of documents and archival and quantitative records).*
>
> (Yin, 2004) introduction pxii

Informants were selected using a chain sampling method (Miles and Huberman, 1994). Initial key contacts helped identify other individuals who they felt would have insights which were relevant to the study. The potential problem inherent to chain sampling of identifying subjects belonging to a limited network was overcome by taking more than one starting point for the chain. Subjects were identified because of their experiences of the processes of their university, and their experience of the introduction and support of learning technologies in their institution.

The motivations for this approach can be seen as an echo of Allen's analysis of the introduction of Information Systems Strategies in UK Higher Education (Allen, 2003). He observed that…

> *"Beliefs held by individuals and groups about the identity, purpose, and character of the process, the organisation, and its environment strongly affected organisational actions. These beliefs were seen as being produced and reproduced by social processes of story telling and most easily accessed through organisational sagas, legends, myths and stories."*
>
> (Allen, 2003) p62

The purpose of the case study interviews therefore was to support an interpretive use of the various sources of data. The interview data is considered alongside the analysis of static data collected from formal reports and official publications i.e. existing quantitative data in the public domain.

Interview questions were semi structured (see Appendix nn). The design of question topics examined each of the key components of the structure of innovations identified by Damanpour in his meta-analysis of organisational innovation (Damanpour, 1991) summarised as a mindmap below (Figure 5) .

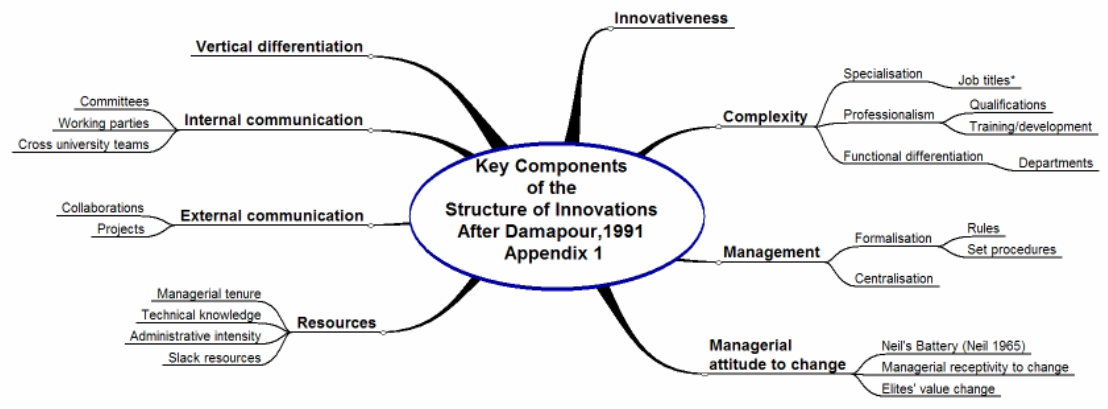



**Figure 5. Mindmap Showing Key Components of the Structure of Innovations (after Damanpour 1991)**

The method of analysis of the qualitative interview data is based on grounded theory (Strauss and Corbin, 1997, 1998) where theory emerges from the analysis of the interview data. NVivo 2.0 software was used as an analytical tool to assist this approach (Bazeley and Richards, 2000). This enabled the generation of annotated transcripts of the interviews to reveal and present the outcomes of the analytical process and clearly identify the 'stratification' (key concepts and their inter-relationships) of the data.

## 2.5 Mixed Method Approach

The desire to explore possible answers to the initial questions, along with the workplace origins of the thesis resulted in a mix of qualitative and quantitative methods.

This mixed method approach is consistent with that used in other similar studies an the uptake and adoption of technologies – see for example (Attewell, 1992) and (Brewer and Hunter, 1989, Fichman and Kemerer, 1997).

Mixed method approaches have become more widespread in recent years (Creswell, 1998, 2003). A major advantage of the mixed method approach is that it supports the drawing of conclusions through triangulation of the data (Frechtling and Sharp, 1997, Huberman and Miles, 2002).

## 2.6 Conclusions

This chapter has summarised the research methods used in the construction of the thesis and the rationale underlying the mix of approaches which were adopted.

It explains the context in which the research was begun and outlines the way in which quantitative data collected by the Scholar Project and qualitative data from the Scholar Project and gathered from a set of case studies will be used together alongside published static data from the public domain to result in a mixed method approach.

The next chapter will provide a time based account of the development of computer technology and its role in relationship to education.

# Chapter 3 Technologies Retrospective

*"A computer terminal is not some clunky old television with a typewriter in front of it. It is an interface where the mind and body can connect with the universe and move bits of it about".*

(Adams, 1992) p86

**This chapter considers the origins and development of learning technologies following the creation of the first stored-program computers. This history identifies ways in which individual academics and teachers have used technology in education.**

**These early practices have established traditions of use which continue to exist in disciplines and educational contexts today. This used inevitably also established the common understanding of how computers might be used in education. They also helped establish our expectations of the potential of technology in an educational context.**

**In Chapter Two it was argued that the beliefs and expectations held by individuals and collectively in organisations are important in shaping current use and the uptake of new methods, these examples serve to reinforce this point. Further evidence on current views is presented in Chapter Eight 'Attitudes: The Academic Perspective' and Chapter Nine 'Experience: The Institutional Perspective', which look more specifically at academic and institutional perspectives.**

**The literature identifies a series of parallel motivations for change**

- **exploitation of available technology;**
- **prevalent educational approaches;**
- **emerging technology affordances.**

**This chapter will focus on the first of the three motivations**

**Understanding the beginnings of technology is useful since it helps identify ways in which learning technologies were of value to early adopters. It assists**

**in tracking the emergence of various affordances of technologies (Gaver, 1991) and can help to identify some of the initial motivations for using technology. However, the insight gained from this understanding also raises the question: "Why, despite these clear motivations, has the use of learning technologies not become more widespread?"**

Using computer technology as a part of the process of education and the support of teaching and learning is not new. The association between computers and education began very soon after the first stored-program computers came into use in the late1940s. The value of history in documenting lessons in the development of computer science has been acknowledged (Mahoney, 1988) and its wider value continues to be a subject for debate (Cox, 2000).
The bulk of the literature describes analyses and evaluates individual applications and implementations. Some works exist which bring together and analyse the nature of the progress. In a few instances, there have been large-scale purposefully conceived experiments and there was also some bold and visionary future gazing.

It is not clear, however, whether we can draw many initial conclusions beyond

a) over time many people have been involved in the development and increasingly sophisticated use of learning technologies;
b) people who know a great deal about information, education, teaching or technologies often have visions for the ways in which they all may be used in the future.

## 3.1 Terminology

The application of computers to educational ends has been variously described as Programmed Learning, Instructional Technology, Interactive Courseware, Computer Assisted Instruction (CAI), Computer Based Training (CBT), Computer Based Instruction (CBI), Computer Based Learning (CBL), Computer Assisted Learning (CAL), Technology Based Instruction (TBI) and educational technology. More recently, we have seen the arrival of descriptions such as Interactive Multimedia, Online Learning, Web Based Teaching (WBT), Computer Supported Collaborative Learning (CSCL), Virtual Learning and e-learning.

The various labels and descriptive phrases whilst having some persistence, tend to occur at particular times in the literature. They provide context and to some extent reflect their fashionable currency. Typically the labels also often indicate the nature of a particular technological method; for instance in the terms ‘Programmed’, ‘Computer’, ‘Technology’, ‘Interactive’, ‘Online’, ‘Web-based’, ‘Virtual’. The labels also indicate some nuances in the nature of the educational approach, as in the differentiation between training, instruction and learning in CBT, CAI and CBL. The differentiation of terms can also be seen to indicate an allegiance to some set of underlying beliefs and philosophical approaches to educational processes; CBT and CAI for example suggesting a possible instructivist root. There are many instances where a title is retained in use from the 1960’s to the present day, such as CAL or CBL which are perhaps the most widespread. In these cases, they may have been retained through inertia and adherence to a consistent labelling system, rather than necessarily reflecting the actual practices and processes which are taking place.

For the purposes of this document, I shall use the term **learning technologies** to refer to the whole range of applications of computer technology in an educational context. This term is not intended to imply any specific underlying approach or educational philosophy, but rather to encompass the many different approaches which exist. This chapter includes an analysis of the application of learning technologies in Higher Education in the UK, but also draws on evidence from outside the UK and from beyond Higher Education.

The rest of this chapter is concerned with laying the foundations for tracing the ways in which development the three components of technology, education and technology affordances interplayed in the evolution of learning technologies.

## 3.2 The Exploitation of Available Technology

One way in which the uses of learning technologies were shaped was by the power and capabilities of computer technology. As suggested at the start of this chapter, developments can be seen as the function of a number of different but inter-related factors primarily reflecting:

- exploitation of available technology

- prevalent educational approaches
- emerging technology affordances

In the case of exploitation of available technology, this comprises a number of facets:

1. **technology** (e.g. computational power, programming languages, systems architecture)
2. **costs** (e.g. cash, programming time, technical support)
3. **current imperatives** (e.g. military objective, educational change)
4. **computing paradigms** (e.g. hypertext, computer mediated communication, web based learning, virtual learning environments

In providing this account some reference will inevitably be made to the affordances of the technology – by which I intend to take my definition from Gaver

> *"the notion of affordances … a way of focussing on the strengths and weaknesses of technologies with respect to the possibilities they offer the people that might use them".*
>
> (Gaver, 1991)

The next chapter will look more specifically at the affordances which emerge from the dual threads of technological and educational change.

Formal approaches to instruction using 'current' technology for education and training have distant roots, as suggested by Saettler who traced a systematic approach to teaching back to early tribal cultures which invented pictographs to record, archive, reproduce and transmit information (Saettler, 1968).

## 3.3 Teaching Machines and Early Computers

Much closer to the time of this study, the concept and realisation of a mechanical Teaching Machine had been achieved by 1926 when Sidney Pressey had designed a mechanical "teaching machine", a device designed to assist drill and rote learning. Initially this was used for automated testing. He developed the equipment further and concluded that automated instruction assisted learning by providing immediate reinforcement, pace setting and active responses (Saettler, 1967). Pressey's

experiments were curtailed through lack of funding, although his methods were to be revisited in later decades.

Analogue and electro-mechanical systems for general applications such as data and information processing were used in the period immediately prior to the era of the digital stored program computer. The needs of the Second World War were a spur to technological development which brought about some of the earliest hybrid electronics based educational technology applications. For example, the US Navy and Bell Labs developed flight simulators for pilot training where the inputs to the various controls were intercepted manually and appropriate feedback generated.

Stored-program computers came into use in the late 1940's. At this stage computers like Colossus, ENIAC and Manchester Mark 1 were the subject of scientific research within mathematics departments at universities in Pennsylvania in the US, and Cambridge and Manchester in the UK. Such developments established computers as both the subject and the means of teaching. Programming in machine and assembly code was used to teach an understanding of the machine fundamentals. This approach was to continue to dominate for the next three decades.

Technologically, this was the beginning of the era of mainframe computing. Financial and infrastructural constraints meant that educational usage was mostly confined to military training applications with a limited number of academic applications (Lumsdaine and Glaser, 1960).

The US military were major users of computers, and were amongst the first to see the potential for using computers to complete repetitive tasks. The military had substantial training requirements and identified a number of areas where computer based training could be implemented, ranging from complex purpose-built flight simulators (Burnstein, 1987) to computerised versions of programmed learning. The development and use of the Whirlwind system at MIT in the 1950s is an example of a purpose built computer simulator (Redmond and Smith, 1980).

US military training applications developed in the 1950's were followed by the early, predominantly text based, educational applications of learning technologies (Reiser, 1987, Reiser, 2001) which used computers as a means of taking the learner through some structured teaching activity (Orlansky and String, 1979). Buck and Hunka cite

the Adaptive Keyboard Instructor (SAKI) developed in the early 50s as typical of the one purpose instructional devices developed during this early phase (Buck and Hunka, 1995). At IBM, work was undertaken to develop a more general approach, initially with the Model 650, to provide Computer Assisted Instruction. This experience fed in to the later development of the purpose built IBM 1400 and 1500 series Computer Assisted Instruction Systems. Work on these systems was undertaken in conjunction with academics from Stanford University and the systems were used in various contexts: in-house IBM staff training applications, in schools and universities, and in Naval and Signal establishments.

The increasing complexity of computer systems was also making their use for teaching Computer Science more difficult and prompted the commissioning of specially designed 'simple' computers such as the SOLIDAC developed in Glasgow during the late 1950s (Thomas, 1993)

## 3.4 Cold War and the Space Race

In the US there were strong strategic motivations to develop national technological expertise because of the politics of the Cold War and the Space Race (Aspray and Williams, 1994). This produced funding from agencies such as the National Science Foundation. In addition, many companies either donated computers to universities or rented them at reduced educational rates. Systems were physically large mainframe computers using timesharing with connections between machines relying on the existing telephone infrastructure.

Researchers were experimenting with early mainframes during the 1960s basing program structures on behaviourist psychological models. For example the PLATO (Programmed Logic for Automatic Teaching Operations) Project at the University of Illinois (Bitzer and Johnson, 1971). However, PLATO also introduced tools currently found in collaborative systems such as email and file sharing. It was a multi-user time sharing system and its authoring language – called TUTOR supported the development of a variety of software applications. In just three years, PLATO achieved use in both schools and colleges.

High profile research into computers and education was established at Stanford under Patrick Suppes and at Illinois through the PLATO project (Bitzer and Johnson, 1971). According to Suppes writing in the Scientific American in 1966

> *"by mid-1965 more than 800 computers were in service on the campuses of various American universities and that these institutions spent $175 million for computers that year".*

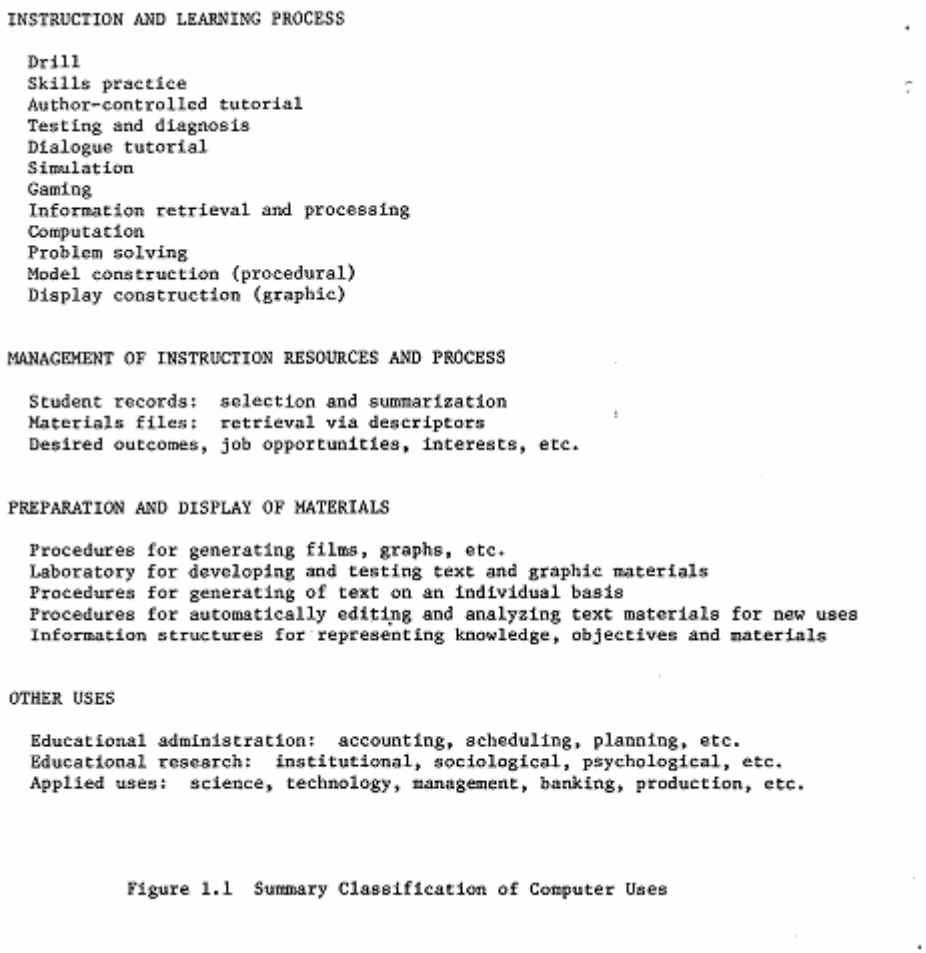
Having discussed the prevalence of the teaching of programming, he goes on to observe

> *"The truly revolutionary function of computers in education, however, lies in the novel area of computer-assisted instruction. This role of the computer is scarcely implemented as yet but, assuming the continuation of the present pace of technological development, it cannot fail to have profound effects in the near future".*
>
> (Suppes, 1966).

At this time, those who created educational and training applications either used ordinary programming languages or instructionally oriented programming languages, such as CAL, CATO, Coursewriter FOIL LYRIC, WRITEACOURSE PLANIT, MENTOR and Tutor (Sammet, 1974).

However creating educational applications was not an activity which could easily be undertaken by teachers or academics (Kiesler and Sproull, 1987) and for this reason active participants in learning technologies during the 1960s most frequently came from one of two backgrounds: audiovisual education or programmed learning. This era also sees the increasingly frequent references to Instructional Technology (Saettler, 1967, Knirk and Childs, 1968), perhaps a fact in itself evidence of the establishment of a new a research area in its own right.

We can gain an insight into the then current understanding of applications of computers for instruction and learning from the research by Karl Zinn whose findings published in 1971 were summarised as shown below in figure 3.1.(Figure 6)



INSTRUCTION AND LEARNING PROCESS

Drill
Skills practice
Author-controlled tutorial
Testing and diagnosis
Dialogue tutorial
Simulation
Gaming
Information retrieval and processing
Computation
Problem solving
Model construction (procedural)
Display construction (graphic)

MANAGEMENT OF INSTRUCTION RESOURCES AND PROCESS

Student records: selection and summarization
Materials files: retrieval via descriptors
Desired outcomes, job opportunities, interests, etc.

PREPARATION AND DISPLAY OF MATERIALS

Procedures for generating films, graphs, etc.
Laboratory for developing and testing text and graphic materials
Procedures for generating of text on an individual basis
Procedures for automatically editing and analyzing text materials for new uses
Information structures for representing knowledge, objectives and materials

OTHER USES

Educational administration: accounting, scheduling, planning, etc.
Educational research: institutional, sociological, psychological, etc.
Applied uses: science, technology, management, banking, production, etc.

Figure 1.1 Summary Classification of Computer Uses

**Figure 6. Zinn's taxonomy of computer uses from surveys in the late 1960s and1970s.bmp**

The foundations for future changes in the nature of computer applications were being laid during the early 1960s (Leiner *et al.*, 1997). A project at US Advanced Research Projects Agency (ARPA) brought together and realised the research and vision of computer networking initiated by Licklider and Kleinrock and Roberts from MIT. It presaged the reality of globally connected computers through the creation of the packet switched infrastructure of the ARPANET. By the end of the decade, it had linked computers four universities: UCLA, Stanford Research Institute, UCSB, and the University of Utah. A similarly significant advance was achieved when PDP launched the first mini computer ‘the PDP-8’ in 1965. The launch marked a step change in the cost of computing; at $526 per month it cost just 6% of IBM’s smallest System 360 (Steinmueller *et al.*, 1995).

Writing some eight years later on “Mini-Computers in a Social Science Instructional Context”, Ronald Anderson and Jonathan Gross commented

> *“Technological change is rapidly moving us into the age of the pocket computer, but in the early 70s we can be content to work with computers no smaller than typewriters. Little computers have long been popular in behavioral laboratories; only recently have they been seriously considered for broader purposes such as instruction or modelling. In this paper we will examine the factors behind the mini-computer phenomenon, explore the broad possibilities for sociological research/instruction, and describe a mini-computer social statistics package under development”.*
>
> (Anderson and Gross, 1972)

## 3.5 The Advent of Micro and Personal Computers

Subsequent and equally important developments include the first microcomputer, the Altair 8080 kit computer in 1975, the launch of Apple II in 1977 and the first IBM personal computer in 1981 (Billings and Moursund, 1988). These technological advances introduced new desktop computer architectures at prices and in volumes which would go on to support the widespread adoption of new models of computer usage in the educational context. Projects which applied computers to teaching were sponsored and the impact of the technology researched (Handler, 1975, Nold, 1975, Laddaga, 1977, Smith, 1977, Askov, 1978, Rubenstein, 1978, Smith, 1978).

Although the seventies saw the growth in experimental use of computers for teaching, the scope of developments was limited since the extent of underlying technologies still predominantly restricted applications to a text-based environment (the IBM 1500 series was a notable exception which could include an audio system and special film projector).

The development of mini computers, and their comparative low cost, did however lead to greater possibilities for students to have hands-on experiences of computer programming and there remained a strong belief that significant benefit could be derived from computers in education by using them to teach individuals how to program (Anderson and Gross, 1972, Kiesler and Sproull, 1987, Ehrmann, 1994). Experimentation and encouragement to promote the widespread use of learning

technologies in the UK at University level can be dated back to 1973 when the National Development Programme in Computer Assisted, Learning was created (Hooper, 1977).

In 1972 Phillips unveiled the laser videodisc, also know as interactive video. This provided a means of achieving a step change beyond the predominant text based applications, since a laserdisc could provide digital instant access to full screen full motion video, or 54,000 individual photographic images. Space was available for multiple soundtracks (enabling multi-lingual discs) and instant jump technology. These systems were to wait for computing technology to catch up; they came into more widespread use when they could be coupled with micro computers and active players were not brought into use until late in the decade. It was seen as the means of integrating large quantities of realistic graphics into computer programs. However systems, required additional hardware and software drivers (Sigel *et al.*, 1980, Haynes, 1989).

## 3.6 Computers on the Campus and the Desktop

By the eighties, applications were broadening out in range and variety, a change which again reflected the underlying change in technology away from centralised mainframe computers. There are many different types of system (Carnegie, 1972, Lukesh, 1987) and Geoghegan identifies the 80's as a period of "fairly rapid growth" in the use of computers for educational purposes (Geoghegan, 1996a).

Among the various examples, one of the best documented initiatives was in the US where Carnegie Mellon University engaged in campus wide experimentation of using computers in teaching during the early 1980s (Kiesler and Sproull, 1987).

In 1981 the personal computer was launched by IBM and the development of personal computing was accompanied by the development of sound and video capabilities which heralded the era of multimedia. Interactive video (Burnstein, 1987, Laurillard, 1987), launched a decade earlier, was utilised in a range of educational applications including Palenque and the BBC Doomsday Disc (Tapper, 1986, Wilson, 1987, Wilson, 1988). Computer graphics systems for PCs also developed. In the UK widespread educational use of micro computers such as the BBC Micro and the RM 380Z in schools were funded by government initiatives and gave rise to a plethora of

programs designed for teaching. In the US in 1986 Apple launched HyperCard on the Mac which made a significant impact through its ease of use, and stimulated a wide range of educational applications. (Stanley, 1992, Culp and Watkins, 1993, Baker *et al.*, 1994).

Other ways in which applications could be created were becoming more accessible to non-specialists, through straightforward programming languages such as Basic and Pascal, and specialised if rudimentary authoring languages such as TenCORE. (Dean, 1994).

Decreasing price and a growing range of machines resulted in more widespread access to technology and provided opportunities for large-scale experimentation. For example in the US, Project Athena at MIT (Schön and Turkle, 1987). Similar scale activities took place at Stanford and Carnegie Mellon. However, the creation and use of computer based materials in learning and teaching was still restricted to a small number of enthusiastic academics and teachers.

## 3.7 The Network Comes of Age

The 1990s saw the beginnings of an increasing ubiquity of technology, the growth of technology based consumer products and a growth in the belief that diverse technologies would inevitably converge (Negroponte, 1995).

Multimedia technology continued to become more sophisticated as the relative power and cost of computers continued to fall in the 1990's. In 1992 the first MBone broadcast took place. The World Wide Web protocols developed at CERN by Tim Berners-Lee to support scholarship within the physics community were unveiled to the wider world in 1993, supported by the NCSA Mosaic web browser. The web found early adopters in educational communities. Its significance lay in the way in which communications across computer networks were simplified and thus provided a realistic means to support multi platform and cross platform delivery, which was proving to be a significant barrier to the widespread uptake of educational courseware programs (Thomas and Neilson, 1995).

By this time authoring languages had developed further, incorporating multimedia control and frequently operating via a visual interface. Programs such as

Macromedia Director and Asymetrix Toolbox were popular and could be used by teachers and academics as well as technical specialists, while for those with programming skills who wanted to create faster more complex applications Java provided additional flexibility across a range of platforms (Gosling and Steele, 1996).

The Computers in Teaching Initiative (CTI) was begun in the early 1980s (HEFCE, 1998a). This was followed by the TLTP (HEFCE, 2001) which in the initial phases placed emphasis on the production of learning resources to be used in undergraduate teaching. Many of the approaches adopted in TLTP echoed the findings of the NDPCAL Initiative some twenty years earlier (Hooper, 1977). The vast majority of the TLTP projects were concerned with the solution of particular learning and teaching problems within a specific course or curriculum area. Thus in the UK in the early 1990s the predominant model for the way learning technologies were implemented was one of **delivering** learning via the computer.

> *"There are at least five major technological innovations in the past that are comparable to the current computer revolution: written records, libraries, printing, mass schooling, and testing. A brief examination of them can help develop an historical perspective on the future of computers. The current operational use of computer-assisted instruction also raises a number of issues of a broad educational and social nature: individualization of instruction, standardization of instruction, complexity of instruction, and freedom of education. Future developments relate to: computers that talk, computers that listen, the use of knowledge and the need for new or more empirical theories of learning and instruction. Through appropriate use of the new technologies of computers and television, structural changes can be expected in education, from elementary school to higher education".*
>
> (Suppes, 1992)

Suppes was writing with more that 30 years' personal experience at Stanford where he used and researched the application of technology to education at school and university level. He recognised the way in which technology and education worked together.

The development of computers and the transition from mainframe through mini to microcomputer took place alongside a transition in educational and psychological

theories of learning. Prevailing views of what might be effective educational methods was one of the factors which had an impact on the way in which early adopters were motivated to make use of learning technologies. The next chapter presents a broad picture of changes in educational thinking and practice which occurred concurrently with the technological advances outlined above.

## 3.8 Learning Technologies in the UK

the use of learning technologies in the UK since the early 1990s Change in Higher Education may be initiated and driven by a wide range of factors as summarised in below (Figure 7). The rest of this chapter is concerned with a detailed exploration of the various aspect of this change.

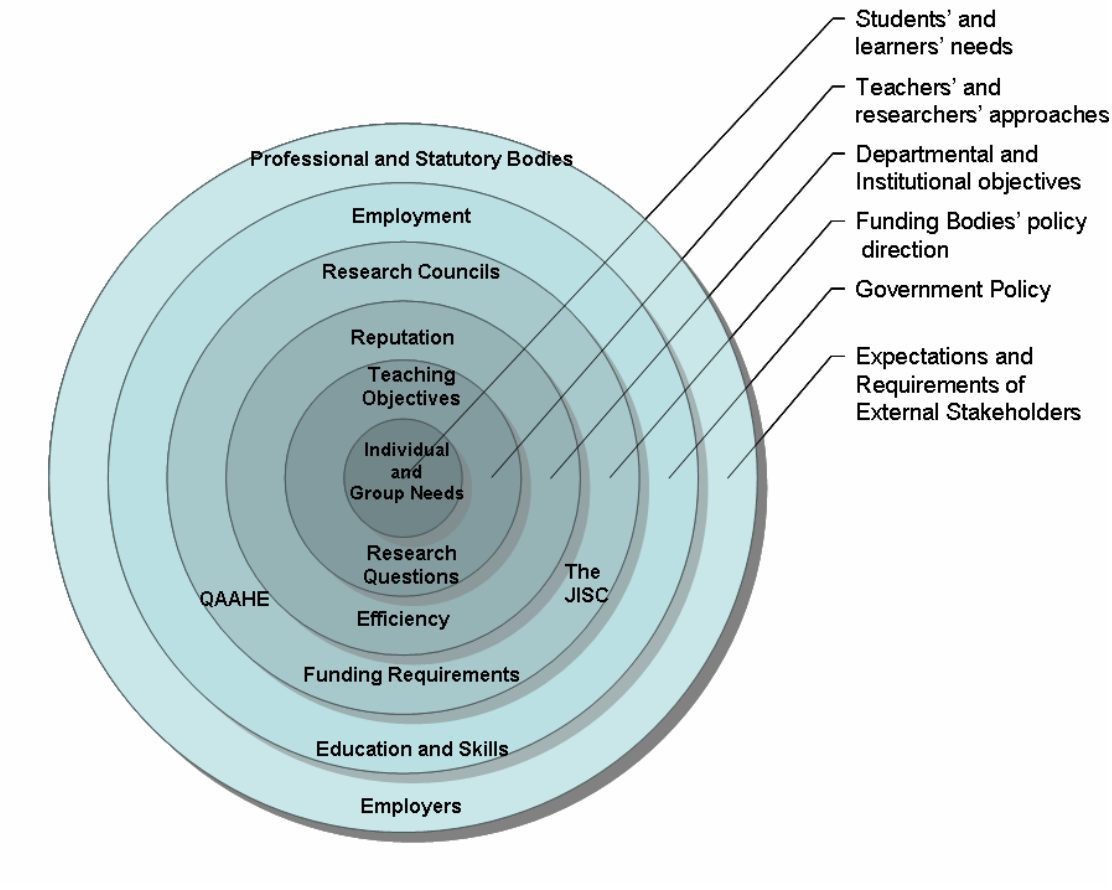



**Figure 7. Hierarch of influences which impact on a learner's experience**

In 1992 the UK Higher Education community accelerated its progress towards technology-enabled learning and teaching through the nation-wide initiative of the Teaching and Learning Technology Programme (TLTP). The programme was run through collaboration between the four national funding councils. It was launched with the objective of promoting “effectiveness and efficiency” in teaching and learning in the UK through the use of technology (Davies, 1994) and aimed to promote collaboration between universities in developing computer based teaching materials.

Two types of project were invited in the original call: subject-based projects which operated through a consortium of academics from a range of institutions and institutional projects which focussed on changes in method within individual universities. The second phase extended the range of subject areas, whilst the final phase focussed on implementation projects, rather than those concerned with developing new resources.

Phase 1 made £7.5 million available a year over three years for 43 projects. Phase 2 aimed to extend the range of work already undertaken by Phase 1 projects. It funded a further 33 projects at approximately £3.75 million a year over the following three years. Phase 3, announced in February 1998 focussed on supporting institutions wishing to embed the use of TLTP materials developed in the earlier phases. Typical budgets for each project were £250,000 over three years which represented, in the words of Professor Sir Colin Campbell who headed the initiative “a small amount of tactical funding” (Turpin and White, 1998). Among the positive outcomes of the TLTP observed in a study of the software two are of special interest to this analysis.

> *“ •...the use of TLTP materials had had a positive impact on both staff and students*
> *[and]*
> *•... there is a greater homogeneity within the UK HE sector with respect to use of C&IT in learning and teaching than in other countries, largely due to the effect of centrally-funded initiatives”*
>
> (Haywood *et al.*, 1998)

Over the nine-year lifetime of the programme, there was a significant fall in costs of individual personal computers and the power that they were able to provide at the

desktop and the use of communication networks was transformed by the advent of the World Wide Web. At the same time that individual institutions invested in their campus networks, the extent and capacity of the Joint Academic Network (JANET) and Super JANET increased across the UK academic community. Services provided across the network were developed nationally by the Joint Information Systems Committee (JISC) and set in train a wide variety of initiatives to enrich the infrastructure of information nodes and gateways.

In a UK wide context besides the ongoing TLTP projects, there were a large number of technology-related initiatives designed to impact on the processes of learning and teaching. Over that time there were more than 100 projects and tens of millions of pounds of investment. This complexity explained by Heywood et al. in their study of the impact of TLTP. A version is included below (Figure 8).

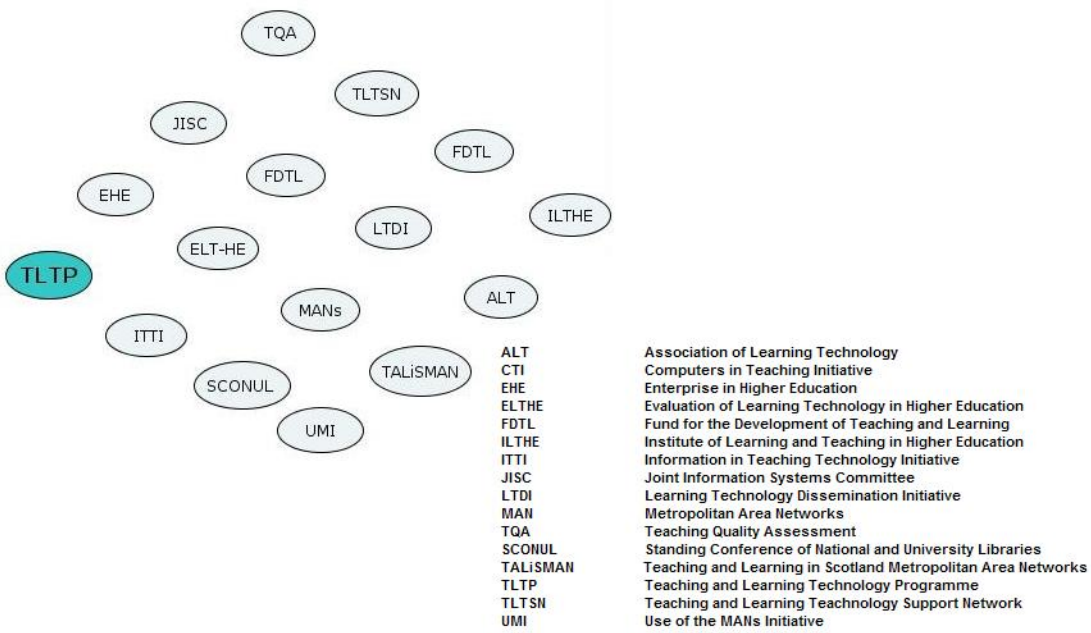



**Figure 8. TLTP and concurrent initiatives through the '90s (after Haywood et al 1998),**

Key amongst these within England and Northern Ireland were those supported by the Fund for the Development of Teaching and Learning (FDTL) (HEFCE, 1996, 1998b).

These projects were primarily motivated by educational objectives although many had technological components reflecting the increasing pervasiveness of technology.

The JISC, through initiatives such as their Technology Application Programme (JTAP) (ESYS, 2000b, Conole *et al.*, 2002) Electronic Libraries (e-Lib) (ESYS, 2000a, 2001) funded work on "leading-edge" technology applications, a significant number of which were concerned with systematic approaches to the use of learning technologies.

The Scottish funding council also put some effort into this area, which might be seen as a positive move to reinforce a national agenda aiming to create a knowledge society. Notable among these Scottish programmes was the Learning Technology Dissemination Initiative and the Use of Metropolitan Area Networks Initiative (Haywood *et al.*, 1997, Ritchie, 2000). UK universities through this period also participated in a range of HE oriented projects in learning technologies which have formed a component of the EU 3rd, 4th and 5th Framework programmes often following on from work initiated by UK projects funded by JISC or TLTP.

One source of UK funding external to Higher Education was provided by British Telecom who ran a project development fund, as well as providing individual research fellowships in HE, some of which were in the area of technological innovations for learning and teaching.

One other technology-related growth area during this period has been evidenced by the appearance of variously named high profile learning resource/learning technology centres. These changes were predominantly, although not exclusively, in those institutions whose libraries were seen to need enhancing following the removal of the binary divide thus ensuring that universities and the former polytechnics had more comparable library and associated learning support resources.

Within the timescale of TLTP significant additions to the breadth of debate were provided by the MacFarlane Report.

> *"The development and imaginative use of shared educational resources and the necessary research into learning processes and new forms of large scale*

*teaching, will all require new organisational structures and the creation of supporting infrastructures at national and institutional level"*

(MacFarlane, 1992)

Laurillard took a more individualistic view In Rethinking University Teaching (Laurillard, 1993) putting the spotlight on the challenges of making effective use of educational technologies to improve teaching. MacFarlane and Laurillard both identified the importance of advice and assistance. This area of work became the focus of subsequent support network initiatives such as CTI, TLTSN and LTSN subject centres

The Computers in Teaching Initiative (CTI) had a remit to support and promote the use of technology in UK Higher Education. It had originally been established in the late 80's following on from the recommendations of the NDPCAL initiative (Hooper, 1977) so was already in existence at the very beginning of the TLTP. The CTI eventually consisted of 24, support and advisory centres with a central managing support centre. In 1996 as a follow on to phase 1 of the TLTP initiative, the funding councils established the Teaching and Learning Technology Support Network (TLTSN) which was created to address technology and learning and teaching from an institutional perspective. In organisational terms, the TLTSN was able to provide an additional, complementary service to augment the discipline based perspective of the CTIs.

Experience from a range of TLTP institutional projects (Tucker, 1996) and institutionally based Scholar Project at the University of Southampton (Hall and White, 1997, White, 1997, White and Maier, 1998), identified a set of successful activities required to achieve the integration of learning technologies. and by implication, institutional change within HE. Successful approaches were characterised as those which secured a high degree of ownership of the change within the departments, faculties or schools directly responsible for teaching.

### 3.8.1 The UK Learning Technologies Research Community

Whilst much of the work described in this chapter had been concerned with the development, implementation and dissemination of new practices for learning and teaching with technology, this area also benefited from some intentional growth in

research. Work was done in centres such as the Knowledge Media Institute and the Institute for Educational Technology at the Open University and Bristol University's Institute for Learning and Research Technologies (ILRT), along with variously named institutes for computer based learning which focussed on learning technologies.

From the point of view of the UK funding councils, some further research into the potential of technology in HE was supported by the Economic and Social Research Council (ESRC) through their general programme under the four theme areas of Technology and People; Innovation; Knowledge; and Communication and Learning. The ESRC also funded specific programmes such as the 'Learning Society' and the 'Virtual Society?'. Similarly, the Engineering and Physical Science Research Council (EPSRC) funded some work looking at emerging technologies which would have an impact on learning and teaching innovations, particularly within funding themes such as Human Factors; Human Computer Interaction; Cognitive Science; and Multimedia Systems.

### 3.8.2 Institutional Developments

Alongside this proliferation in research and implementation projects, the community of practitioners who crafted the new technology based learning experience grew. Publications on learning and teaching and technology increased and thus the learning and teaching technology community was growing from the bottom up.

The community can be evidenced not only by publications across a wide range of journals, but also through conferences and a large number of workshops, seminars, electronic discussion groups and project specific dissemination events. The survey of TLTP conducted by Haywood et al identified more than 130 publications for the TLTP projects studied (Haywood et al., 1998).

This burgeoning community benefited from a concerted effort by the funding councils through the JISC to establish a high quality sector-wide technological infrastructure. Although it was originally established to support research, it grew and developed to serve the needs of learning and teaching. The eLib programme, for example, worked to establish subject oriented information gateways to provide consistent quality support across the entire sector.

However, in the middle of these two, at the level of the individual institution, activities were less well defined. Some institutions capitalised on the benefits of network investment and the climate of innovation brought about with the increased interest in the use of learning technologies. The literature suggests that many institutions engaged in small-scale experimentation in the use of learning technologies. However, given that there are some 130 universities and colleges of Higher Education, it is difficult to identify very many systematic approaches to large-scale institutional change through technology.

There were major projects at a number of universities. The Open University purposefully included technology in their distance learning; Sheffield University committed to the campus-wide adoption of Web-CT, De Montfort University unveiled their Electronic Campus. Coventry announced Learn Online, The University of Northumbria in Newcastle had a campus-wide initiative called UNNFURL and the University of Luton and Loughborough University both established institution-wide use of Computer Assisted Assessment. Other institutions with high activity included Oxford Brookes, University of the Highlands and Islands, Lincoln and Humberside, Nottingham, Napier, Glasgow, Sheffield Hallam, Strathclyde and Thames Valley University.

### 3.8.3 Steering Institutional Developments

Funding councils employed four distinct approaches which sought to influence institutional approaches to learning technology, through the JISC, The Teaching and Learning Technology Programme, The Teaching and Learning Support Network and the Teaching Quality Enhancement fund.

#### 3.8.3.1 The JISC

The JISC ran developmental projects in this area. It also pushed for Information Systems Strategies to be used as a means of establishing learning technology policy. JISC produced guidelines for the development of such strategies and provided ongoing support through their JISC ASSIST Centre (JISC, 1995, 1997, 1998), and institutions embarked on actively implementing new approaches (Dhillon, 2001).

Whilst much of an information strategy impacts necessarily on the administrative and support functions of an institution, decisions made will impact significantly on the

future direction of the institution with regard to learning and teaching, as was recognised by Allen and Wilson in their analysis of the implications of JISC initiatives.

> *"In terms of teaching and learning, therefore, the information strategy must set out a basis upon which, for example, computer-assisted learning is to be developed within the institution, the extent to which distance learning is to be developed, the extent to which distance learning and teaching is to be assisted through computer and telecommunication networks, including television and interactive video, and the extent to which the development of teaching skills, teaching quality, and the development of the teachers' knowledge base is to be assisted by access to computer-assisted learning and remote information sources".*
>
> (Allen and Wilson, 1996)

#### 3.8.3.2 TLTP and LTSN

There were conscious efforts in the sector to steer the development of the use of learning technologies at an institutional level. Phases 1 and 2 of the TLTP programme included a number of institutional projects (HEFCE, 1996).

The Teaching and Learning Technology Support Network (TLTSN) was built on the activities of the institutional projects. Both are examples of interventions designed to drive institutional pursuit of learning technologies. The TLTSN's remit was to support strategic and infrastructure change brought about by the use of new technology. The funding council's made changes to strengthen these support mechanisms at the end of the decade. The TLTSN and an CTIs were superseded by the Learning and Teaching Support Network. The remodelled network centres were associated with a Generic Support Centre (co-ordinating LTSN activities) a JISC funded Technologies Centre and TechDis which focussed on technology for disabilities. Together these activities represented a significant investment, evidence in itself of a perception from the funding councils (and implicitly with government support) that institutions needed to be guided in the way in which they used technologies for teaching and learning.

#### 3.8.3.3 Learning and Teaching Strategies

The English finding council took a more direct interventionist approach when it decided to use institutional learning and teaching strategies as a means of making educational change. In July 1999 the Higher Education Funding Council for England

(HEFCE) announced an initiative to develop institutional learning and teaching strategies through the use of a Teaching Quality Enhancement Fund (TQEF).

This fund was established following a confidential report commissioned by HEFCE which summarised the status and content of existing Learning and Teaching Strategies identified by a survey of universities, colleges and institutions of Higher Education (Gibbs, 1999).

In June 1999 the HEFCE invited all institutions to submit an Institutional Learning and Teaching Strategy (LTS) by January 2000. They allocated £52.5 m over three years to support institutions in implementing their strategies. The research indicated that, given the state of existing practice, this was a viable initiative, but that many institutions might welcome guidance on developing and implementing a learning and teaching strategy.

This initiative provided a framework to enable institutions to identify, articulate and locate their strategies with respect to learning technologies and to place them in the context of the broader institutional mission and learning and teaching objectives.

Case study material illustrating good practice in a variety of institutions was collated by visiting institutions and reviewing documentation (HEFCE, 1999a). This material, along with the set of defined strategies, served to provide some clearer indication of trends in strategic thinking across the sector.

The funding council's guidance document clearly indicated that it envisaged the use of learning technologies as an integral part of institutional learning and teaching strategies. It stated that the Institutional strand of the funding could be directed at a number of areas including “innovations in learning and teaching, especially in the use of communications and information technology” (HEFCE, 1999c).

Among the six national priorities which institutions might wish to address in the content and structure of their strategies, the report suggested

> *“Transferring and adopting good practices in learning and teaching, for example through collaboration between departments and between institutions. This may be on a regional basis and may include,* ***in particular sharing good***

***practice and developments emerging from the FDTL, TLTP and LTSN programmes****".*

They might also consider

*"**Exploitation of communications and information technology in the service of managed improvements in learning and teaching**".*

(HEFCE, 1999c) emphasis added.

### 3.8.4 Government Intentions

Of course the agenda for learning and teaching was not immune to influences from outside the academy. Aside from the National Inquiry into the Future of Higher Education (Dearing, 1997), government played a direct role by commissioning reports designed to stimulate debate and initiate change in the possible future directions for Higher Education and lifelong learning (Fryer, 1997, Kennedy, 1997). Government turned policy into practice by actions such as initiating the University for Industry (UfI). Such initiatives were described by the Secretary of State for Trade and Industry as

*"new strategies to develop [UK companies'] strategies for learning suitable for the knowledge economy. "*

Stephen Byers

'The Future of Corporate Learning.'(May 2000) cited by (Shaw, 2000)

Early in the 1990s government had initiated this type of activity when the Department for Employment and Education funded subject discipline networks and the development of skills for university graduates designed to enhance their employability (McNair, 1990, Whitely, 1995). Successful initiatives were subsequently made the direct responsibility of the university funding councils.

Even inside the universities, the driver for change was not confined to the technological front. There was a diminution of per capita funding, an increase in participation rates from 10 to 30 percent – with a target of 50% participation; and accordingly more heterogeneous student groups.

In addition there have been influential government policy reports which argued the case for widening participation and enabling lifelong learning (Dearing, 1997, Fryer,

1997, Kennedy, 1997). All these changes can be seen in different ways to have been associated with the upheavals which followed the removal of the 'binary divide' which pursued the objective of putting all HEIs on a more equal footing through the mechanism of direct funding from central government.

### 3.8.5 The Quality Agenda

A new regime of evaluating teaching quality was introduced in UK Higher Education in the early 1990s. The Quality Assurance Agency (QAA) was formed following the convergence of funding for all Higher Education Institutions in the UK by the respective national funding bodies for England, Scotland, Wales and Northern Ireland. Degrees awarded by polytechnics, colleges and institutes of Higher Education had been previously been accredited by The Council for National Academic Awards (CNAA). Individual universities were endowed with their own degree awarding powers by royal stature. In the new regime, all degrees were to be awarded by universities.

In order to demonstrate the quality of education throughout the sector, The government established the Quality Assurance Agency for Higher Education which introduced a programme of subject based Teaching Quality Assessment (TQA) inspections.

The TQA visit and assessment introduced a new focus on the processes and practices of Higher Education. Popular comment highlighted the mass of bureaucratic administrative procedures generated by the need to provide evidence of clear quality assurance policies and procedures (Underwood, 2000). Some commentators observed that the processes were a force for conservatism in educational processes (Hammond, 2003).

However, the audit visits provided an opportunity to showcase innovations (especially the use of learning technologies) as a means of demonstrating good practice.

> *"Some providers deploy a wide range of teaching and learning methods, including computer-aided learning (CAL) and the use of the Internet. In the best examples, the use of directed and independent learning is well integrated with taught elements…Learning resources fully support the provision in a majority of*

*cases. Most of the computing and information technology (IT) facilities are high quality".*

(QAAHE, 1998)

In addition there is an interesting symmetry between the perceived drivers for introducing technology into teaching and those identified driving the quality agenda in the UK. The parameters of change that have affected the quality agenda were identified by Green as follows.

*Rapid expansion of student numbers against a backcloth of public expenditure worries*

*The general quest for better public services*

*Increasing competition within the educational 'market' for resources and students*

*The tension between efficiency and quality*

(Green, 1994)

The quality agenda analysed by Green has many parallels with the first phase of the TLTP initiative. TLTP was established with the stated purpose of increasing "effectiveness and efficiency" of the use of technology in learning and teaching. Many initial projects specifically dealt with issues of handling increasingly large student numbers (HEFCE, 1996, Haywood et al., 1998). There had been a growth in the belief that the use of technology would provide new ways of delivering and supporting learning and teaching (Hiltz, 1993) and there were many discussions of the potential of the virtual university (Brown, 1998, Newby, 1999). There was some debate as to whether the use of learning technology actually delivered any financial savings (HEFCE, 1997), while some research showed that the view of the learners was frequently that they did not wish technological solutions to replace face-to-face teaching (Light *et al.*, 1997).

Institutions increasingly used technological infrastructure as a measure of their facilities. Studies of prospectuses bear out the observation that information

technology is used as a selling point in the marketing of courses to students (Crook and Light, 2000)

### 3.8.6 Learning Technologies and Four Concepts of Quality

Green also identified four concepts of quality in Higher Education

*The traditional concept of quality*

*Conformance to specifications or standards*

*Quality as effectiveness in achieving institutional goals*

*Quality as meeting customers' stated or implied needs*

(Green, 1994)

It is useful to consider the extent to which these concepts of quality measures may be relevant or useful in assessing the quality of learning technologies.

#### 3.8.6.1 The traditional concept of quality

Across the UK there was a move to establish a 'gold standard' network infrastructure through the provision of JANET and SuperJANET. However, as has been noted, individual institutions' efforts to be leading players in the use of learning technologies were less clear cut. Some institutions established their reputations as hosts of key data archives. Some institutions prided themselves on the quality of their campus network, others on their high levels of workstation provision, the availability of sparkling learning resource centres, or provision of network points from all study bedrooms. Measures of such infrastructure was not consistent and it was difficult to determine the relative value of each different type of technological investment.

#### 3.8.6.2 Conformance to specifications or standards

Among the recommendations of the Dearing report was a proposal that an Institute for Learning and Teaching would be responsible for the 'kite marking' of computer software. However for the period of this study no clear measure of the quality of software is in use, nor are there active plans for such a development.

It was the JISC who took responsibility for trying to establish standards, beginning with their work on building infrastructure, and subsequently through a strategic

partnership with IMS and the creation of a range of working groups associated with the CETIS, the Centre for Educational Technology Interoperability Standards (JISC, 2001).

#### 3.8.6.3 Quality as effectiveness in achieving institutional goals

For many institutions early applications of learning technologies used IT to build employability and key skills. One of the checklist points which HEFCE provides within their suggested framework for learning and teaching strategies was

> *"Promoting innovation in the curriculum, particularly activity to increase the employability of graduates and diplomates including work experience and developing key skills".*
>
> (HEFCE, 1999a)

The JISC and the Teaching Quality Enhancement Fund discussed above both use the objectives of improving the quality of education as a lever to move institutional goals.

#### 3.8.6.4 Quality as meeting customers' stated or implied needs

In the period of this study tuition fees were introduced in 1999 and the maintenance grant for undergraduate students was removed. Policy makers made increasing references to strengths of the North American models of charging for education. The belief that we were witnessing the commodification of education became increasingly widespread alongside the view, previously applied only to part-time or distance learners, that the learner was a customer (Willmott, 1995, Duderstadt, 1998, O'Leary, 1999, Noble, 2002).

## 3.9 Conclusions

This chapter has looked at the advances in approaches to the use of learning technologies over time. It chronicles the many external initiatives which brought about a growth in the understanding and application of learning technologies. It provides a British context for the rest of the thesis through an examination of the evolution of the use of learning technologies in the UK.

It provides an account of the independent drivers for change in Higher Education which resulted from increasing student numbers and which in turn provided a more

heterogeneous student learner population. Change also followed the government initiated restructuring of the Higher Education sector and the introduction of a new quality audit mechanism across the sector.

The HE sector in the UK has been thorough in establishing a high quality technological infrastructure available for use in learning and teaching. Considerable effort has been put into developing information gateways and amassing national data archives which can be accessible throughout the sector. However the majority of developments of actual uses of learning technology have been more ad hoc. Whether the use has been for subject teaching or general learner support developments have predominantly the work of enthusiasts.

There have been a number of notable national and international initiatives supporting learning technology developments. In addition, there has been a growth of experimentation and research into the use of learning technology. None the less, there are some who argue that the level of sophistication with which we make use of learning technologies has still not progressed past the Model T Ford days (Benyon *et al.*, 1997)

The next chapter will look in greater detail at the way learning technology has worked with prevalent educational models and have been implemented to reflect and articulate a given learning model. It will look specifically at the affordances which emerge from the dual threads of technological and educational change. It will consider the affordances of technology which have become increasingly sophisticated whilst observing the move of the dominant models of learning from behaviourist, through instructivist and objectivist to constructivist and constructionist.

The next chapter goes on to identify and categorise the range of learning technologies currently in use. This analysis will be drawn on in subsequent chapters when considering the relationship between the intrinsic quality of a given learning technology approach and the extent to which it lends itself for use in Higher Education.

# Chapter 4 Prevalent Educational Approaches

*"Teaching machines are unique among instructional aids, in that the student not merely passively listen, watches, or reads but actively responds. And as he does so he finds out whether his response is correct or not. And a record may be kept which aids in improving the materials."*

(Pressey, 1926).

This chapter presents a broad picture of changes in prevalent educational approaches, educational thinking and practice which occurred concurrently with the technological advances outlined in Chapter Three 'Technologies Retrospective'.
It considers prevalent educational approaches categorising them within two broad areas

1. psychological and educational approaches e.g. education, training, behaviourism, constructivism, programmed learning, situated learning
2. educational philosophies, imperatives, strategies and processes

It goes on to consider the way in which the educational affordances of technology emerged to enable an increasingly complex theory of the uses of learning technology.

## 4.1 Approaches alongside technology

One way in which it can be helpful to see the development of educational approaches is to consider the emergence of approaches and theories alongside the timeline of the developing computer. The sections below lay out this development.

### 4.1.1 Approaching the computer age

University education in the UK at the start of the 20th century was building on the heritage of Newman's original exploration of the idea of a university (Newman, 1873).

*"… a school of knowledge of every kind, consisting of teachers and learners from every quarter. … in its essence, a place for the communication and circulation of though"*

(Newman, 1910)

Newman's values persist to this day and may be useful when examining the inter-relationship between university research and university teaching. Newman's view can be identified as influential in the development of civic universities and the values ascribed to liberal arts programmes.

Pre-war information and data handling research and development influenced the subsequent development and application of computer technology. In the same way, the early formalisation of education derived from Newman, Whitehead, Thorndike and Dewey would help set agendas and approaches for the early application of computers in an educational context.

Alfred Whitehead was influential in bringing a more scientific approach to education through his lectures at Cambridge and London in the UK and Harvard in the US on topics which came to be summarised in his set of essays "The Aims of Education" (North Whitehead, 1929). Another influential thinker who published on "The Principles of Teaching based on Psychology" was Edward Thorndike (Thorndike, 1906). Pressey acknowledged that he was influenced by Thorndike when undertaking his work on Teaching Machines.

The scientific approach to education was strengthened by arguments put forward by Dewey initially through his publication "How We Think" (Dewey, 1910) which he pursued (Dewey, 1933) and followed through by active innovations in many public school boards across the US.

### 4.1.2 Early Computer Era

The early computer era also saw the further development of a scientific approach to education prompted by needs of the war effort (Charters, 1945) which is echoed in Saettler's account of the history of instructional technology (Saettler, 1967). The scientific approach in the context of computers and education established a principle which is explicitly stated in the motivations for the creation of the BASIC programming language introduced in 1964 as a means by which "non science students should be taught computing" at Dartmouth (Kurtz, 1978).

As computers became more established in the 1950s the influences upon psychologists and educators included two distinct threads; Skinner's account of the

possible roles which might be taken by technology (Skinner, 1954, 1961) and Bloom's cognitive model of learning (Bloom and Engelbart, 1956)

In his 1954 article "The Science of Learning and the Art of Teaching", Skinner, like Pressey, built upon the stimulus response oriented work of Edward Thorndike (Thorndike, 1912, Thorndike, 1914). He investigated how human behaviour could be shaped with the use of positive reinforcement. Skinner's approach was to give positive feedback at each stage of development. Immediate feedback was also essential to imprint the desired behaviour on the learner. He believed that you had to "program" behaviour in the learner, but also believed in self-pacing of the learner.

Skinner explored the concepts of reinforcement, teaching machines, programmed instruction and the formative evaluation of the instructional process. Skinner's work established a view where, media were seen as a means for reinforcement and thereby can be seen as providing a significant part of the foundations for the field of instructional design. He introduced his first teaching machines in 1958 and by the early 1960s he was predicting that they would radically change schools.

In 1956 the cognitive perspective was brought into the fore when Benjamin Bloom led a team of educational psychologists whose observations and research into classroom learning of mathematics resulted in the publication of the work which has come to be popularly known as "Bloom's Taxonomy". The study of intellectual approaches and levels of achievement in learning provided a model by which educators and training designers could decide how to structure the intellectual content in the most effective manner. This work saw the emergence of a mastery approach to learning which endorsed approaches that varied both time and type of instruction to meet the learner's needs and capabilities. The method suggested to instructional developers a means to match subject matter and instructional methods applicable in the classroom and through technology.

### 4.1.3 Alongside the White Heat of Technology

The Russians launched Sputnik in 1959, the USA embarked on the space race in the 1960's and in 1963 in the UK the Prime Minister Harold Wilson declared it an age of the "White Heat of Technology". During the 1960s research scientists in areas such as psychology, computer science and education had interests in exploring the

potential uses and benefits of computer technologies. As in the previous decade much of the underlying educational philosophy was influenced by behaviourist models derived from Skinner (Skinner, 1954) and were designed to generate programmed learning.

The period saw a lively debate between different theorists as to the processes associated with learning. Bruner (Bruner, 1966) said teachers and instructors should be concerned with the question of the kinds of prior experience that are most likely to predispose the learner to learn. He argued that the way in which learners organise and structure knowledge for the most effective learning, taking into account the sequence of encounters with the materials to be learned, is most likely to result in efficient learning.

> *"Instruction is a provisional state that has as its object to make the learner or problem solver self-sufficient".*
>
> (Bruner, 1966) p53

In 1962 Robert Glaser built upon the work of previous researchers, proposing a model which linked the analysis of learner needs to the design and development of instruction. He coined the term "instructional design" (Glaser, 1962) and subsequently went on to explore the application of teaching machines (Glaser, 1965).

Glaser identified four aspects of a technology of instruction, which would involve

- *analysing the characteristics of subject matter competence*
- *diagnosing pre-instructional behaviour*
- *carrying out the instructional process*
- *measuring learning outcomes*

(Glaser, 1965)

In "The Conditions of Learning" Gagné proposed a taxonomy of behavioural objectives and a related taxonomy of types of learning which have implications for the selection of media for instruction (Gagné, 1965). He outlined eight types or categories of learning, each with its own rules. They were arranged in a hierarchy

from simple to complex on the assumption that each higher-order learning category would be dependant upon the mastery of the one below it. Although stimulus response conditioning, already promoted by Skinner, underpins the base of his hierarchy, Gagné did not accept that the model could be built on conditioning alone, (Burnstein, 1987).

In 1968, Fred Keller proposed using the Personalized System of Instruction (PSI) for college instruction. This elaborated the mastery approach previously identified by Bloom. (Keller, 1968).

Also during the sixties there was growth in the academic discipline of cognitive studies. Piaget and Bruner were influential. Piaget published extensively and his approach to cognition and emphasis on the way in which thinking processes are further developed in Bruner's "Towards a Theory of Instruction" (Bruner, 1966).

The writings of Vygotsky introduced an argument which educationalists could add to the cognitive approaches advocated by Bloom's Taxonomy and laid the foundations for another educational model – that of constructivism (Vygotsky, 1962). From a constructivist view learning is a sense making process where learners add and synthesise new information into existing knowledge structures and thereby integrate new experiences into prior understandings. In this model, the learning experience for each individual is unique and the meaning that each learner derives and each individual's experience is filtered through their personal values, understandings and beliefs.

However, the constructivist point of view challenges the traditional approach to instructional design. The constructivist position that all learners enter at unique levels and derive their own meaning from the learning situation in incompatible with the instructivist aim of achieving specified uniform learning outcomes.

The differences between instructivist and constructivist views on learning technologies were debated extensively in two issues of Educational Technology, edited by Lumsdaine and Glaser, the contents of which went on to contribute to the book Teaching Machines and Programmed Learning (Lumsdaine and Glaser, 1960).

The seventies were a period of consolidation for educational ideas and models of learning. Ideas originally developed in earlier decades were elaborated (Tickton, 1970, Bloom, 1971, Bloom *et al.*, 1971, Bjerstedt, 1972, Carnegie, 1972, Ely, 1973, Gagné, 1973, Wittich and Schuller, 1973, Gagné and Briggs, 1974, Hewton *et al.*, 1974, Bloom, 1976, Marton and Saljo, 1976, Sleeman and Rockwell, 1976, Briggs, 1977).

### 4.1.4 Computers in the Classroom

During the fourth year of its publication in 1971, the journal of the Special Interest Group for Computer Uses in Education (SIG-CUE) contained an article by Thomas Dwyer which demonstrates how the challenge to the instructivist view had been taken up by researchers into learning technologies. When relating the objectives of a project to introduce and evaluate the use of computers in the secondary school classroom…

> *"Primary emphasis is being placed on the importance of each student as a creative person who can learn to use the computer as an exploratory tool. This is in contrast to the programmed learning type of CAI which guides the student in pre-determined patterns. It is hypothesized that the long range value of computing systems in education lies in their ability to provide the individual student with a sophisticated tool that will allow him to explore, make mistakes, and under the guidance of his teacher find his own unique path to 'discovery'".*
>
> (Dwyer, 1970)

Discussions continued throughout the 60s and 70s. Seymour Papert's work with the LOGO programming language provided further refinements away from the constructivist approach towards the development of tools for thinking and understanding in what he termed a constructionist approach.

Presenting at the ACM annual conference in 1972 on the uses of the LOGO programming language on undergraduate instruction, George Lukas of Beranek and Newman Inc. wrote that

*"LOGO is a programming language developed … specifically for use in teaching. … Students without special mathematical ability can use LOGO to do real work on problems previously inaccessible to them.*

*We therefore think that LOGO will have a useful role in the undergraduate curriculum. …LOGO, in fact, has broad application in the undergraduate curriculum. Other uses of LOGO have been developed by us and by others in the areas of artificial intelligence, theory of computation, computers and society, logic, and teacher education".*

(Lukas, 1972)

He observed that work on such educational applications had followed on from the creation of the LOGO language by Wallace Feurzeig some five years previously.

Papert was probably the biggest influence to educationalists using computers in education at this time. Through his work with LOGO Papert explored the power of computers to motivate and enhance learning. He proposed that computers which provided children with opportunities to work on the development of interactive micro worlds thereby enabled learning through manipulating the rules of the system they were trying to understand (Papert, 1980). This approach consolidated developments of the constructivist approach and marked a further conscious move away from the predominantly teacher initiated and controlled behaviourist and instructivist models applied to learning technologies during the previous decades. It was described by Papert as 'constructionism'.

Amongst educational theoreticians, Kolb emphasised the importance of experiential learning and typified learning as a continuous process on a four stage learning cycle (Kolb, 1984) although the importance of experience in education had been identified by Dewey much earlier (Dewey, 1938) and had to some extent already been explored by Thorndike (Thorndike, 1912, Thorndike, 1914).

Rogers developed his earlier views on experiential learning, and contributed to the study of the needs of adult learners with his publication "Freedom to Learn for the 80s" (Rogers, 1969, 1983a). Further understanding of adult learning can be found through Schön's views on the role of the reflective practitioner (Schön, 1987). Schön's theoretical perspective has special relevance to the demands of Higher and

Adult Education. It was to feature extensively in the debate exploring understanding of learning and teaching in subsequent years.

### 4.1.5 Networked Computers and the Social Life of Information

In the 1990s researchers coming from a constructivist viewpoint were active, combining an understanding of Gaver's affordances of technology discussed in section 4.2 below (Gaver, 1991) with the objectives of teaching in Higher Education. This is clear from the influential literature of early 1990s (Jonasson *et al.*, 1993, Laurillard, 1993, Schank and Cleary, 1994). There was greater emphasis on uses which exploited the potential of the technology to enable and enhance communicative and collaborative interactions. Laurillard compared the potential and actual uses of technology with her conversational model where learners and teachers are engaged in a rhetorical activity (Laurillard, 1993),

> *"Teaching is essentially a rhetorical activity, seeking to persuade students to change the way they experience the world. It has to create the environment that will enable students to learn the description of the world devised by others".*
>
> Rethinking University Teaching, p28
> (Laurillard, 1993)

Amongst educationalists and trainers there was also some exploration of learning styles and the approaches to learning (Entwistle, 1988, Honey and Mumford, 1992). Lave and Wegner, working from the base of constructivism and social constructivism, introduced the concept of situated learning (Lave and Wenger, 1991) and communities of practice (Wenger, 1998). At the same time, those engaged in aspects of instructional design began to talk about concepts such as scaffolded learning (Linn, 1995). The use of computer mediated communication offered additional uses of technology in the arts and social sciences beyond facsimiles and digital archives, including concepts such as virtual seminars (Duffy *et al.*, 1995a, Lee *et al.*, 1999). Psychologists developed the ideas of Gaver (Gaver, 1991, 1996) exploring the concept of the educational affordances of technology; activities and learning enabled by the interactions characteristically supported by the technology (Crook and Webster, 1997, Crook and Light, 2000).

The developments of constructivism and social constructivism can be seen in the work on Virtual Learning Environments. For example Harasim et al. describe computer conferencing as the means by which…

> *"learners actively construct knowledge by formulating ideas into words that are shared with and built upon through the reactions and responses of others"*
>
> (Harasim *et al.*, 1995)

Such views can be associated with a wide range of experimentations on themes such as developing online communities and providing opportunities for vicarious learning. (Mayes, 1995, Klemm and Snell, 1996, Mayes and Neilson, 1996).

Subsequently in the UK, work has been done to follow through the change in the theoretical framework (Bostock, 1998, Conole and Oliver, 1998). The theoretical change was also driven by Dearing in the review of UK Higher Education (Dearing, 1997). He explicitly shifted the focus of university technologically-supported education by literally putting (constructivist) learning in front of the technology, through the consistent and purposeful use of the term Communications and Information Technology (C&IT) rather than the previously prevalent Information and Communications Technology (ICT).

## 4.2 Emerging technology affordances

The literature recounts a technological progression which moves through three broad periods:

- programmed learning;
- computer assisted learning/instruction;
- interactive multimedia.

### 4.2.1 Programmed Learning

Reflections on the potential of technology are spawned as readily as the technology itself. Observing the implications of the technological advances brought about during the Second World War Vannevar Bush commented:

*"The world has arrived at an age of cheap complex devices of great reliability; and something is bound to come of it".*

(Bush, 1945)

Early applications on mainframe computers followed on from, and took place alongside the use of radio and television for instruction, and there are clear overlaps between the instructional methodologies used by the various media at this time (Saettler, 1967).

Programmed instruction had some long-term effects on learning technologies. The programmed instruction movement led many researchers to focus their attention on the process of instruction rather than the media. Programmed instruction thus had a direct or indirect influence on the development of several technologies of instruction, such as branching programmed instruction, programmed teaching and programmed tutoring (Heinich, 1984, Heinich *et al.*, 1989).

### 4.2.2 Computer Assisted Learning/Instruction

The use of computers for training and teaching became a significant minority activity in the 1960s. Geoghegan (Geoghegan, 1996b) cites Patrick Suppes, who headed research at Stanford University into Computer Assisted Instruction, wrote in the Scientific American on "The Uses of Computers in Education" stating

*"Both the processing and the uses of information are undergoing an unprecedented technological revolution…. This is perhaps nowhere truer than in the field of education. One can predict that in a few more years millions of schoolchildren will have access to what Philip of Macedon's son Alexander enjoyed as a royal prerogative: the services of a tutor as well-informed and as responsive as Aristotle"*

(Suppes, 1966)

From our modern perspective of an increasingly technological world, it is important not to overlook the predominant educational media of the time. Language learning embraced instructivism pooling multiple media (text, audio, visuals) and used specialised technology to create language laboratories. In the 60' distance learning was synonymous with correspondence courses. In the United Kingdom political

motivations to create widespread educational opportunities harnessed print, radio and television and established the Open University (Wright and White, 2001). Common applications in the arts were on mainframe computers where large archives were stored digitally and supported textual and literary analysis. The use and development of the Intermedia system at Brown University in the US typifies by this application area (Yankelovich, 1986, Yankelovich *et al.*, 1988, Walter, 1989). In Science and Engineering, computers were the province of mathematical research, and educational applications used programming exercises as a means of instruction.

Applications termed Computer Based Training and Computer Assisted Instruction were developed to provide isolated instructional activities, conceived in their own right to take the learner on a particular pathway through a set of instructional materials. Such applications typically made strong use of the precepts on Instructional design. Computer Based Training expanded into commercial applications beyond its initial applications within the computer and defence areas. Creation of resources had become a little less difficult, but it still required technical specialists to produce materials.

### 4.2.3 Interactive Multimedia

At the end of the 1970s established use of the ARPANET enabled early messaging and email systems (Ruthfield, 1995) and text based adventure games became popular. Distributed network-based games (Multi User Dungeons) came to be known as MUDs and subsequently evolved to 'MUDs Object Oriented' or MOOs (Bartle, 1990). MOOs have been used educationally, especially in language learning, as learning technologies began to encompass computer mediated communication (CMC) and computer supported collaborative learning (CSCL).

The potential of technology to support distance learning was being explored (Mason and Kaye, 1989, Bates, 1994) with key drivers coming from two directions

1. existing Open Universities who were keen to make use of another technology
2. educationalists trying to work with geographically dispersed learners who saw the web and email providing opportunities which had not previously existed.

In the UK there was a major government initiative undertaking a scoping study to identify the potential impact of such changes. It is illustrated by this quote from a UK government report “The changing business of learning”

> *“Education and learning are experiencing massive change, particularly with Higher Education increasingly being delivered electronically outside the traditional lecture theatre and directly into living rooms across the world. The impacts of distance learning are likely to be great - not least for the providers of traditional education. The student of the future is likely to be significantly changed. There is likely to be a huge market in educational software, with opportunities for export. The market is likely to develop rapidly and the emerging industry needs to be able to respond by producing and using the material. We want to create networks to build scenarios on what learning in the future will be like and to consider the impact of social change, learning needs, the market opportunities and the impact of funding for traditional suppliers of education.”*
>
> Winning through Foresight: Action for Leisure and Learning,p4
> (HMSO, 1997)

Concepts of microworlds discussed by Papert began to be realised as simulations which were observed to be highly motivating for students, improving productivity and promoting the acquisition of knowledge and skills (Means *et al.*, 1993).

The growth of “virtual communities” and popularisation of the concepts of virtual reality and cyberspace owed their heritage as much to fiction (Gibson, 1986) as to historical accounts of actual communities such as The Well (Rheingold, 2000). In educational terms this was realised first as an exploration of the pedagogic potential of the technologies (Mason and Kaye, 1989) and subsequently as an extensive debate on the future of campus universities in the face of global “virtual universities”. (Marchese, 1998, Newby, 1999, 2000). This debate took place in the context of the emergence of private for-profit initiatives in the US (Noble, 1998).

In Canada and Australia it prompted research developments such as the Virtual-U at Simon Fraser University, Canada (Harasim, 1999) led by Linda Harasim who

researched and published extensively and influentially on the use of computers to support learning. (Harasim, 1989, Harasim et al., 1995)

This period saw a growth in debate and discussion on the nature of learning and teaching when enabled by technology. To some extent this followed on from arguments first developed by Papert (Papert, 1980). Duffy explored the relationship between different approaches (Duffy and Jonassen, 1992) while in the book “Engines for Education” (Schank and Cleary, 1994) the authors argue the case for “learning by doing”. They demonstrate how interactive computer systems can be used to a) overcome limitations of face-to-face methods of learning by doing and b) can be used to develop environments which explicitly support this method of learning through “active learning”. Schank argues that most multimedia programs fail because they "merely add video and graphics to page-turning programs" and that good educational software must be active not passive (Schank, 1994). Active learning was a concept taken forward by a variety of publications, for example the journal Active Learning originally published by the UK Computers in Teaching Initiative.

## 4.3 Sociological Drivers

In looking back over the different influences for change in technology, the strongest of recent years have been what Collins et al. termed the sociological (Collins *et al.*, 1989). The World Wide Web (has been the most effective technology in this respect. Use of the Web to deliver non-interactive material irrespective of geographical boundaries, sometimes on a ‘pay as you go’, or ‘pay per view’ basis is part of the important shift which reflects changes in the underlying social organisation of institutions.

Institutions may also have been looking to reduce their unit cost of delivery and have therefore been strongly driven to change to an electronic mode of delivery. This approach enables the transfer of printing costs away from the institution, to the learner. The driver may also sometimes come from education’s longest standing resource bank – the library. Libraries of all types are increasingly looking at the digitisation of part of their collections for a wide variety of cost related reasons. The availability of traditional resources in digital format may itself form a new driver for change in addition to those identified in the other sections in this chapter.

In some cases pressures for change in the modes and methods of delivery have been driven by external factors. There may be a need to administer new schemes of more portable and possibly modular qualifications perhaps acquired at different institutions. Or it may be that study needs to take place over a longer period of time than has conventionally associated with taught undergraduate and postgraduate taught courses. It may be seen to offer additional incentives to provide basic learning resources in a way which can be accessed irrespective of geographical location.

## 4.4 Conclusions

This chapter has looked at the advances in educational and philosophical approaches to the use of learning technologies over time and the interplay between prevalent educational theories, affordable technology and the increasing maturity of computer based systems. The approach taken in this thesis is to view the current role of learning technologies as providing additional learning resources, which must be integrated into the total learning experience.

An important aspect of the development of the use of learning technology has been the way in which it has reflected and articulated a given learning model. At the same time as the affordances of technology have become increasingly sophisticated, we have observed the dominant models of learning moving from behaviourist, through instructivist and objectivist to constructivist. In the behaviourist model the learner is trained to respond to a given stimuli as a motivation for acquiring skills and knowledge. In the objectivist model knowledge is located outside the learner and exists separately from the learning context, the instructivist approach depicts a roadmap to learning and instruction which can be followed to achieve the outcome of knowledge and understanding. In the constructivist model the learner, engaged in acts of understanding, constructs knowledge, derives meaning and situates it within the context of existing understanding. It is debatable whether as yet the use of technology for learning has managed to effectively integrate and reflect the constructivist model (Jackson, 1998) but this would appear to be the predominant direction which had emerged by the early 21st century.

In the next chapter the categorisation of learning technologies is considered. Categorisation can work as an adjunct to basic understandings of technological affordances.

# Chapter 5 Categorising Learning Technologies

**This chapter examines ways in which Higher Education exploited the affordances of learning technologies during the 1990s. The ways in which computers were used to support Higher Education led to a number of distinct areas of research and development. Applications and approaches emerged which served specific strategic organisational objectives. These applications and approaches are observed within institutions, specialist schools or department and in pursuit of specific educational objectives within a discipline or vocational areas.**

**This diversification reflects a growing maturity of learning technology applications and greater sophistication amongst its users. It suggests that the drivers for the use of learning technology increased during the period, an observation which will be revisited in subsequent chapters (Chapter Six 'The Growth of Theory' and Chapter Seven 'Change and Innovation'.**

## 5.1 Categorisation and Affordances

Categorising learning technologies is important because it can help identify ways in which individual managers and academics, or those within a particular academic discipline may conceptualise the potential uses of technologies for teaching and the support of learning. Categorisation can be viewed as a means of making explicit inter-related affordances (Gaver, 1991) of various technologies. A widespread understanding of the affordances of a particular technology may be a motivation for academic departments or institutions to pursue a strategic implementation of learning technologies with specific organisational or educational objectives.

## 5.2 Application Areas

Chapter Four 'Prevalent Educational Approaches', outlined specific approaches to using learning technologies which emerged within Higher Education as a result of changes in prevalent pedagogical thinking. Evidence of these approaches is provided by the learning and teaching literature. The mindmap below (Figure 9) identifies various approaches in learning technologies and suggests some of their inter-relationships.

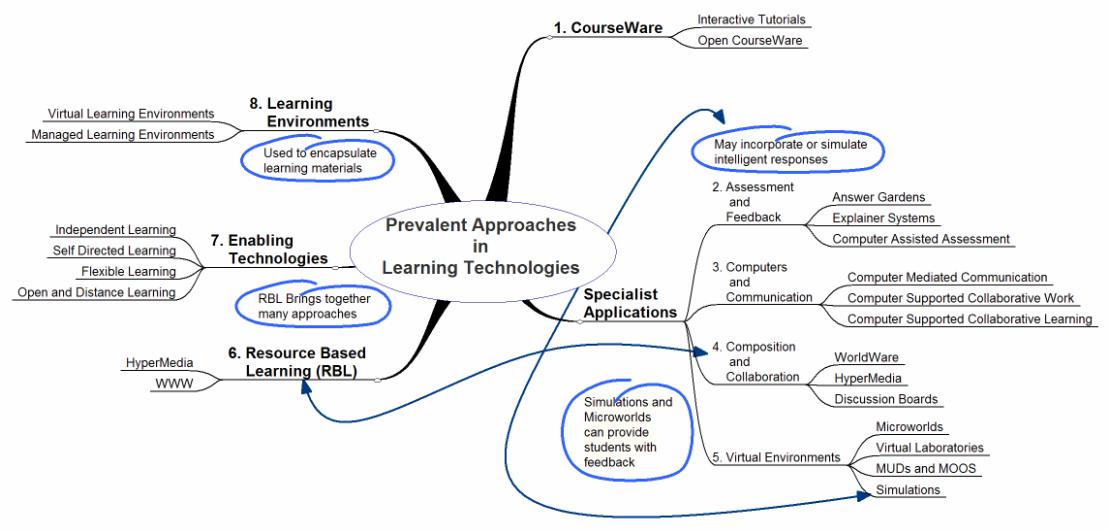



**Figure 9. Mindmap Showing Prevalent Approaches in Learning Technologies**

Although the terms are sometimes closely related, they are not interchangeable. The terms identify a set of themes for research and development of learning technologies which emerged during the 1990s. It is important to note, however, that these perspectives do not exist solely within the context of technology in Higher Education; many are synonymous with key areas of development for generic approaches to education and training. Some, such as the communications technologies, are used routinely by individuals in their personal life, and by individuals and organisations in the workplace.

### 5.2.1 CourseWare

CourseWare became of shorthand term for a whole range of interactive tutorials during the 1990s. Interactive tutorials were among the first applications of technology to learning and teaching (Falk and Carlson, 1995). Growing out of the drill and practice style learning of instructional technology, they are still sometimes seen as being educationally useful. Interactive tutorials are used to guide the learner in a relatively constrained manner through a clearly defined set of pathways. Early applications were implemented as text-only computer based training (CBT) run on mainframe and mini computers. Systems were later developed for personal computers and small local networks using authoring environments such as HyperCard and ToolBook. As the development of educational applications became

more widespread, specialist authoring languages designed for educators rather than programmers were also developed.

Interactive tutorials were often complex, offering a significant number of clearly defined learning pathways. The user might typically be guided using explanation by example and then asked to solve a simple problem in a similar domain. Often a linear, book style, metaphor was adopted. The learning objectives and pathways which the user would follow might be presented as chapters, laid out in a sequential manner. If there was a review of learning achieved, then it would usually be predetermined using some simple Computer Assisted Assessment (CAA).

In the university sector in the UK it has been most usual to see such applications produced by the academic subject experts themselves who have all the requisite subject knowledge (Hooper and Toye, 1975, HEFCE, 1996, 1997). Although there are many individual examples of this style of development world-wide, a centrally funded UK government initiative resulted in a large number of such programs being produced under the UK Teaching and Learning Technology Programme (HEFCE, 1996). Two indicative example applications are WinEcon produced by a consortium of Economics departments (Soper, 1997)and INTERACT (Thomas and Neilson, 1995) a similar initiative through collaboration in engineering departments.

In some cases authoring languages effectively functioned as prototype tools. Programs developed with authoring languages were often limited to a single delivery platforms. Configuration and installation across a wide range of differing types of hardware or network configurations was frequently problematic. Desire for faster interactivity or more sophisticated running might result in an application being redeveloped using a programming language when commercial backing became available to publish the application. Once the use of the World Wide Web had become established after its introduction in 1993, the Web became a means for educators to develop cross platform courseware using languages such as Java. Web based applications are discussed further under resource based learning in section 5.2.6.

### 5.2.2 Assessment and Feedback

Computer Assisted Assessment (CAA) is a specific computer application which has become increasingly widespread. It is most commonly associated with objective testing often in a multiple-choice format, although a range of other test types can be implemented. Scalability and rapid feedback are often highlighted as key strengths of computer assisted assessment. Systems can also generate large amounts of statistical and analytical information on areas such as question validity and cohort performance. Early applications used optical mark reading to mark objective tests completed on pre-printed question sheets. Later applications ran on local area networks and the World Wide Web.

Developments have included specialised testing engines (stand-alone or web based), custom built testing programs, and testing facilities integrated into managed and virtual learning environments. (Brown *et al.*, 1994, Darby, 1994, Gibbs, 1995, Partington and Peel, 1996, Westmeyer, 1996, CASTLE, 1998, Miller *et al.*, 1998, Brown and Glasner, 1999, Brown *et al.*, 1999, Bull and Stephens, 1999, Paull *et al.*, 1999, Bhalerao and Ward, 2000, Nichols and Greenhow, 2002).

Another means of providing feedback is to use an intelligent explanation system. These systems are capable of receiving questions and generating answers in real-time like a private tutor (Wooley, 1998). When extended to incorporate multimedia resources the resulting tutoring environment can be extremely effective. A number of approaches to the development of such systems have grown out of the application of expert systems to education. An example of such a system is the Explanation Planner of which responded to the user selecting information from a choice of perspectives(Cornell *et al.*, 1993, Woolf and Hall, 1995). The Explanation Planner applied various constraints on the content and organisation of explanation in order to supply an appropriate response. It simulated a human explainer's efforts to choose and incrementally develop a model of the topic under discussion. Learners were able to use of the mouse to incorporate multimedia elements from the Explanation Planner into their own documents. This enabled them to construct a "live" document including the discussions around a topic during a session with the system.

The HiDES project at the University of Southampton (Hall and Colson, 1991) gave history students explanation and feedback about the relevance of documents to

support or counter an argument they were presenting or an analytic task for which they were collecting evidence. The system matched the documents that the student had cited against a “model” list provided by the tutor. It provided feedback from the tutor as to evidence they may have missed and why it may have been significant to the argument.

Another approach that facilitates the provision of explanatory advice to students is that adopted in the Answer Garden (Ackerman and Malone, 1990, Brailsford *et al.*, 1997). The original concept of the Answer Garden was not designed for use in education but rather for the distribution of information from an organisation’s “memory” i.e. the diffuse pool of authoritative knowledge present in an organisation but not in any individual. Answer Garden was designed to tap this pool of information to support tasks such as technical support or customer hotlines where there is a continual stream of questions, most of which recur frequently, but where there are always some that are novel. Answer Garden presents users with a branching network of diagnostic questions about their problem. If there is an appropriate answer in the database, this will be found; but if there is no such answer, an e-mail will automatically be sent to a relevant subject expert. Both the questions and the answers are eventually incorporated into the database which thus evolves of its own accord. The “intelligence” in the system is provided by the human experts but in such a way as to enable the database to incorporate new answers and explanations for future use when the same or similar question is asked again. This approach has been successfully applied in education and the concept extended (Mayes and Neilson, 1995). It has been applied successfully in collaborative learning environments and can also be used to support a conversational model of student-tutor interaction (Cox *et al.*, 1999, Jones and Webb, 2000). This area of research was followed through by work under the ESRC “Virtual Society?” initiative in the UK, which took real discussion between learners and tutors as the raw material from which a new kind of courseware could be built (Mayes, 1997). This courseware encapsulates some of the features of composition and collaboration software which are described in section 5.2.4

### 5.2.3 Computers and Communication

As well as transforming the way in which CourseWare was developed and used, widespread access to the World Wide Web also provided many new opportunities to use communication technology in education. Common computer based communication approaches are referred to as Computer Mediated Communication (CMC), Computer Supported Collaborative Work (CSCW) and Computer Supported Collaborative Learning (CSCL). In these approaches the use of technology supports alternative communication paradigms from those created within traditional face to face teaching (Harasim, 1989, Mason and Kaye, 1989, Bates, 1994, McConnell, 1994, McBride and Dickstein, 1996, Bonk and King, 1998, CSALT, 2000).

Communication pathways can be teacher-student, student-student and student-teacher. They can be one to one, one to many, many to one and many to many. Communications may be synchronous or asynchronous and may be private or public. Information can be presented in a range of formats (text, audio, visuals) and the content (conversational artefacts) can have persistence.

Probably the most powerful applications which evolved took advantage of the asynchronicity of computer based communication systems. Unlike a face-to-face conversation a computer based communication allows discussions to take place intermittently. Computer networks also support dialogue between geographically separate participants. Computer based communication methods proved particularly effective in academic disciplines which placed a high value on scholarly discourse (Hammond and Bennett, 2001). It is also effective in situations where students were unable to attend classrooms or lecture halls at the same time and place. Computer based communication has been used to support small group teaching amongst very large student cohorts thus overcoming the problems of providing very large numbers of small teaching rooms.

### 5.2.4 Composition, Communication and Collaboration

The potential to use composition, communication and collaboration to change the nature of learning was much discussed. The mindmap below (Figure 10) identifies the components of activities using composition, communication and collaboration.

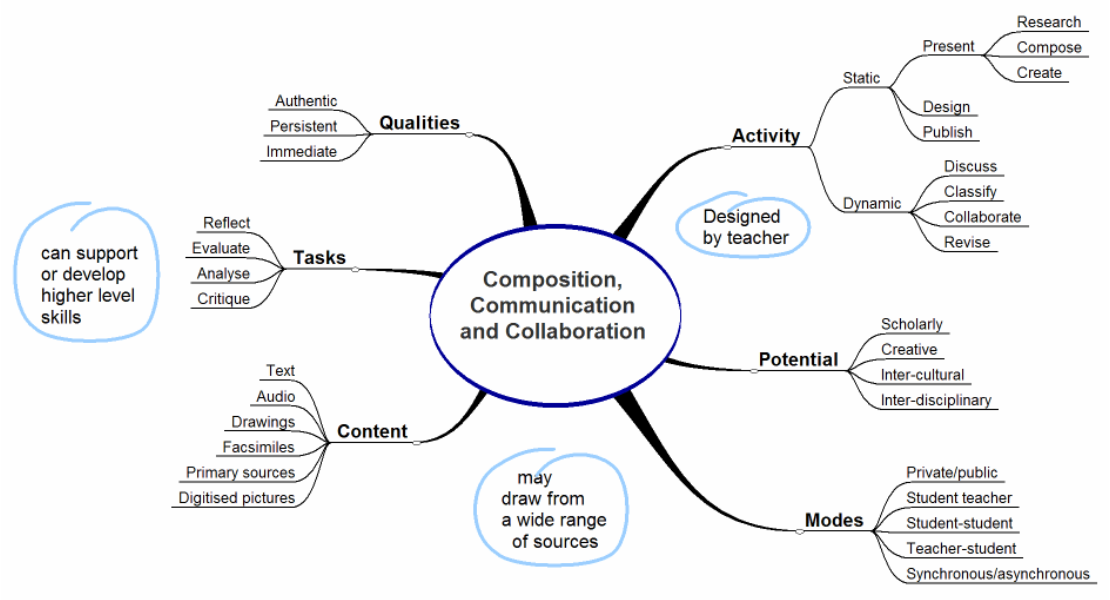



**Figure 10. Mindmap Showing Aspects of Composition Communication and Collaboration**

Researchers suggested that literacy skills developed by creating and using multimedia compositions may come to be regarded equally as essential as writing is today (Mills and Pea, 1993, Wolfe, 1995). In examples where researchers give accounts of learners creating multimedia artefacts outcomes included learners working individually or collaboratively, developing critical and reflective skills, learning by doing, and positive student experiences (Guzdial and Soloway, 1992, Wolfe, 1995).

Examples of students creating their own hypermedia resources which then become the focus of active learning are becoming increasingly widespread at school, undergraduate and postgraduate level. Psychology and Cognitive Science undergraduates have presented summaries and discussed seminar topics online (Light et al., 1997). Work at the University of Southampton has involved pre-university science students writing their own online journal (Fullick, 1997, Scl-Journal, 2003). In another academic area, music students have taken part in electronic small group discussions based on their course lectures and the hypermedia pages analysing the work of modern composers which had been produced by the students themselves.

The modern music seminar course was designed to be a mixture of lectures and virtual seminars. Students publish their seminar papers on a Web site, the class read the papers and then engage in email discussion of the content. The rationale behind this style of delivery can be derived from research in other universities (Duffy *et al.*, 1995b) which suggested several advantages in electronic rather than class seminars. Students were able to research and consider their contributions to the discussion, so the quality was higher and could include references, examples, etc. Quiet students could be more inclined to contribute, all contributions could be saved and assessed, and completing the coursework incorporated the acquisition of a number of transferable IT skills.

### 5.2.5 Virtual Environments

Computer based simulations provide learners with a virtual environment – they can experience a 'world' without actually being there. Early literature and research came out or the artificial intelligence community and referred to microworlds (Lawler, 1984). However the term virtual environment became more widespread after Gibson's popularisation of Virtual Reality (Gibson, 1986). In education, especially science and engineering the term simulation is also used. In this case a simulation is an educational environment which effectively supports project based learning via the computer. Whether they are called microworlds, simulations or virtual environments, they all set out to achieve similar educational objectives; to engage learners in situations within which they solve or explore problems set in scenarios related to their area of study (Papert, 1980, Means et al., 1993). Such applications may take many forms, including

1 scenario-based simulations

2 knowledge or model-based simulations

3 multi-platform multi-user environments

Scenario-based simulations are excellent examples of complex integrated systems using video, graphics, sound or voice to engage the user. However, these and most other scenario-based simulations provide only a discrete number of paths through a problem. The system has no knowledge of the problem beyond its pre-set points and

does not adapt its presentation based on perceived user needs or knowledge. Typically a scenario-based presentation takes the student through a highly constrained set of cases in which problems or approaches might be chosen by the user who selects from a menu of choices at selected points in a video or graphical animation. Such systems might not have knowledge about events in the simulation, nor a causal or discrete event model of the activities. A student typically cannot ask questions about the particular situation nor request updates on particular state variables. A scenario-based simulation cannot respond based on authentic knowledge of the situation.

Knowledge based or model based simulations contain a mathematical model of the situation and might additionally use a planner, plan recogniser and user model. Such a system might make assumptions about the user's knowledge and learning needs. A model-based simulation requires a complex representation and sophisticated control structure in order to be flexible and responsive to the user.

Simulations are often used to train students in low-frequency or high risk events, e.g., working with toxic materials, dealing with mechanical breakdowns while flying a plane, encountering high winds while fighting a fire and responding to rarely seen cardiac arrests in an emergency room. In a real-time simulation, just moving the simulation into the situation to cover the desired pedagogical goal can be complex. Such simulations might use a plan, execution and monitoring system to manoeuvre the real-time simulation toward a pedagogical goal.

Multi-platform multi-user systems grew out of role-playing games. Extensive use is made in subject areas such as language learning – and to some extent these systems are special applications of computers for communication.

### 5.2.6 Resource Based Learning

Resource based learning is the name given to an approach developed originally in the context of language teaching which used a range of physical resources e.g. slides, facsimiles of documents, audio recordings, video recordings, paper based exercises (Wright and White, 2001). The advent of low cost computer hardware made it feasible to transfer these types of resources onto computers, and the approach was seen to be appropriate for a large number of different academic areas

(Parsons and Gibbs, 1994, White, 1994, Hall et al., 1995, Brown and Smith, 1996, Wright and White, 2001).

Resource based learning emerged as a focus area in the early 1990s in response to the realities of using different educational technology resources in the support of learning (White, 1994, Grabinger and Dunlap, 1995, Hall et al., 1995, Brown and Smith, 1996). It is not always possible to classify educational software into one of the categories described in this chapter. A simulation may include a drill and practice component and an Answer Garden may include elements of conversation and collaboration as well as explanation and may direct the student to simulations or drill and practice exercises, or more traditional paper-based educational resources. A richly resourced computer-based or computer-mediated learning environment will include resources of many different types. These could include the same topic presented in different ways to allow for students of varying backgrounds and preferred learning styles, or the use of different styles for different elements of the course, or a combination of both.

Since the days of programmed learning in the 1960s, educationalists have advocated the 'packaging' of self-paced learning resources into integrated learning environments for students following particular courses. Over the years this has developed into what we now might refer to as open or resource-based learning which incorporates computer-based material. Distance learning courses must by their very nature rely heavily on such components for their existence, with the added complication that tutorial guidance and methods of assessment must be available to the student at their place of study (Bates, 1997).

Cheaper storage media and ubiquity of the World Wide Web has heralded an era when increasingly all the material that students need to access for the courses they are studying is available electronically, whether it is **their** tutor's notes, textbooks, reference material, or specially designed educational software described earlier in this chapter. Students can then use such "digital libraries" of resources as the main foundation for their studies. However, as with traditional libraries, just pointing students at a collection of information does not constitute an effective teaching or learning experience. It is still necessary to direct students to make good use of the resource material to achieve particular learning goals. This can be done using

traditional methods such as lectures, tutorials and paper-based instructional handbooks, but increasingly tutors have been able to make use of the growing number of authoring systems that enable them to package computer-based resources into instructional courseware components (Ingraham *et al.*, 2002)Hypermedia systems offer the potential of integrating information in different computer-based resources through cross-referencing and cross-linking. One system which demonstrated the possibilities here very well is the Microcosm system that was developed at the University of Southampton (Davis *et al.*, 1992, Hall et al., 1996). The Microcosm system consisted of a number of autonomous processes which communicated with each other by a message-passing system. No information about the hypermedia links was held in the document data files in the form of mark-up. Instead all data files remained in the native format of the application that created them. All link information was held in link databases (or linkbases) containing details of the source anchor and the destination anchor and any other attributes pertaining to the link such as a description. This model has the advantage that it is possible to support different sets of links for different users applying to the same data. It is possible to define link anchors for documents to which the author has read-only access. The philosophy of Microcosm included the ability to link anything to anything and the model allows for the definition of links in non-text media (images, video, audio, etc.) and in data generated by third-party applications such as databases and CAD systems. This allowed authors to create integrated learning environments from resource material that were generated by a variety of different application programs. Some examples of how Microcosm has been applied in education are given in Woolf and Hall (Woolf and Hall, 1995).

Very soon after its public introduction in the mid nineties, the Web became a standard environment for delivering digital resource material. Many educational institutions went on to make instructional material available to students as a matter of course via the Web. Comparisons were drawn between the growth of open courseware and the development and achievements of the open source community (Baldi *et al.*, 2002). The value of being able to publish material which could be easily linked to other reference material also available via the Web was one model of use. Another was that of integrating reference materials to interactive components developed using programming environments such as Java.

A Web version of Microcosm was developed to facilitate the cross-referencing of Web-based material (Carr *et al.*, 1995, Hitchcock *et al.*, 1997) and the development of successful open and interoperable systems on the web was rapidly established as a fruitful area for ongoing research and development. As well as having an in-built document management system which enabled both authors and users to have direct access to the resources in an application, Microcosm incorporated a "guided tour" facility which enabled authors to direct students to follow particular paths through a set of resources.

Many systems include the concept of computer-based guided tours. A number of projects, including the one based at Southampton, have extended the model to include dynamically generated tours based on the needs and profile of the student user . Such systems use “guides” or “agents” with varying degrees of intelligence, which can help direct the student through the resource material. Schank has developed this idea particularly well in his ASK systems and Story Archive ideas (Schank, 1994, Schank and Cleary, 1994).

### 5.2.7 Enabling Technologies

Independent, self directed, flexible, open and distance learning were terms used to describe approaches which use affordances such as persistence, asynchronicity and distributed information. Different techniques which exploit these strengths of learning technologies were researched and developed. They were seen as a means of supporting teachers and accommodating the needs of learners who might, either through their educational background, specific education needs, or through their mode of study, would not find traditional face-to-face approaches suitable or appropriate for their needs (Mason and Kaye, 1989, Rowntree, 1992, Steeples *et al.*, 1994, Bates, 1997). The approaches encompass paper-based resources, electronic web pages, computer based lessons and interactive tutorials which can be used by an individual without the concurrent intervention of a teacher or tutor.

### 5.2.8 Learning Environments

Virtual Learning Environments (VLEs) and Managed Learning Environments (MLEs) are typically used to encapsulate access to a range of computer based learning applications and resources with the addition of a standard user interface access

enabled via the World Wide Web. (Cook, 1999, Nachmias *et al.*, 2000, Scheuermann *et al.*, 2000, Squires *et al.*, 2000, Jenkins *et al.*, 2001, Condron and Sutherland, 2002, Everett, 2002, Ingraham et al., 2002). The types of activity which students might undertake are illustrated by the diagram (Figure 11) below.

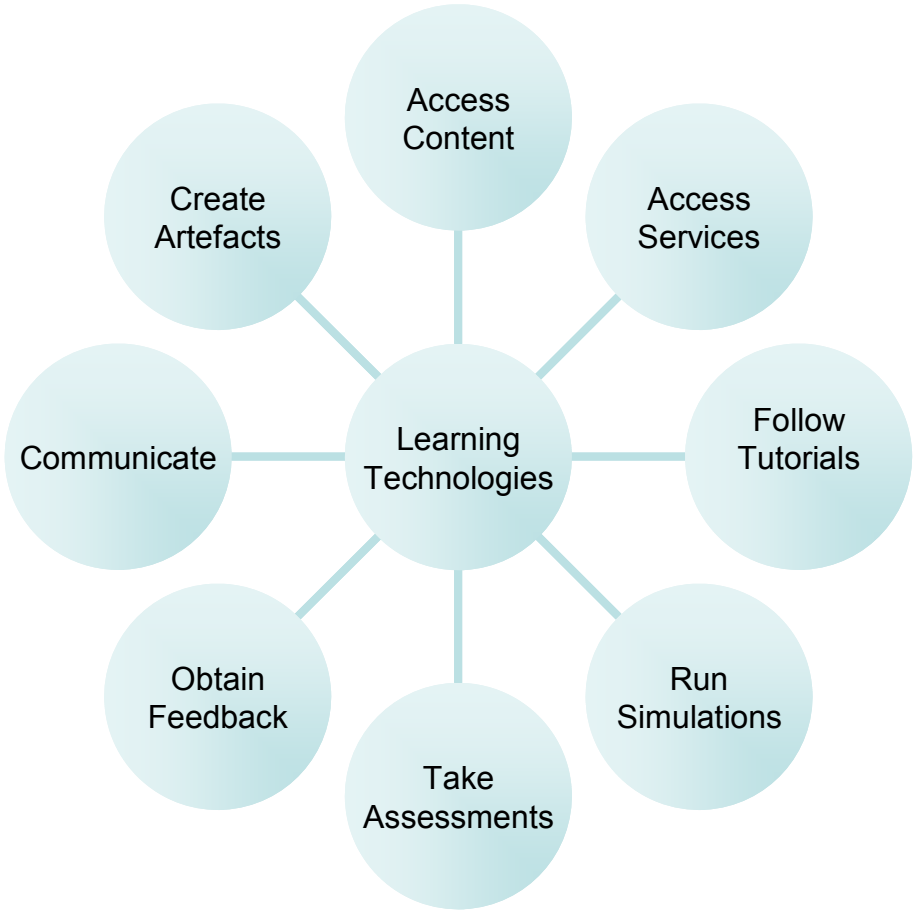



**Figure 11. Learning technologies from the learner's perspective**

Managed learning environments are those which typically work in conjunction with a student information system or management information system to provide additional student progress tracking and class management. VLEs were quite heavily promoted by their vendors for offering the benefit of providing the learner with a single web based environment for a range of different learning activities. They have also been seen as being accessible to non-specialist authors since generally creating courses using a VLE or MLE would not require web-programming skills. Although VLEs can

be used to provide complete online courses, particularly those which provide distance learning, in the UK Higher Education VLEs are predominantly used within specific teaching units or modules, see for example (Bennett and Pilkington, 2001, Chalk, 2002).

## 5.3 Applications, Approaches and Motivations

The various types of application which have been described above reflect ways in which the technology affordances have been developed to address educational objectives. The diagram below (Figure 12) illustrates how different approaches can be associated with particular learning technology applications which were described in section 5.2 above.

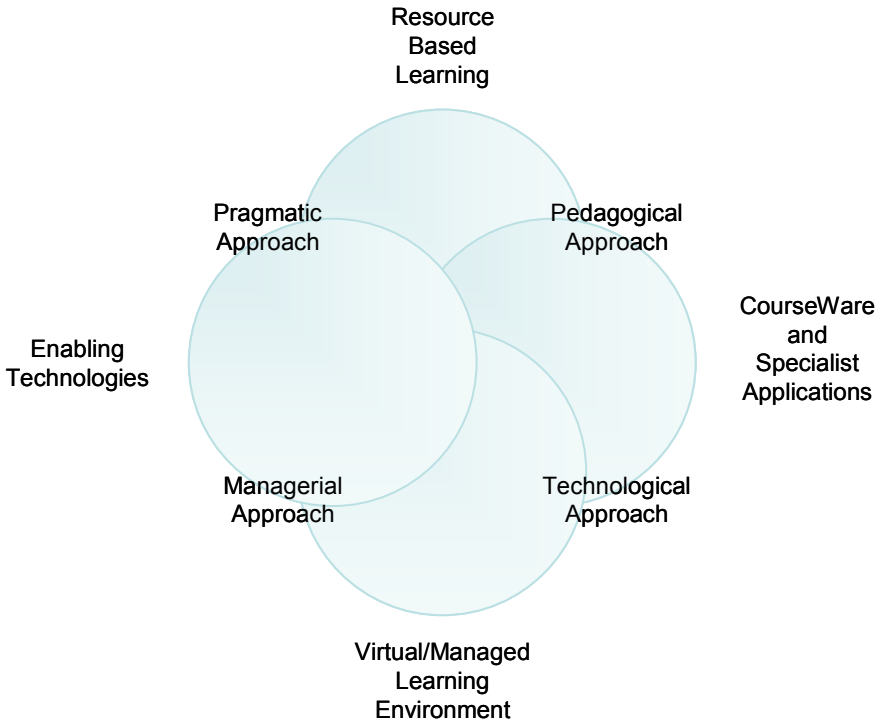



**Figure 12. Learning technology approaches and motivations**

In a university, different functions will be associated with different perspectives. For example the managerial view (and motivation for use) will be different to that held by

the individual academic, or from the service specialist providing computing support. These differences are explored in more detail from a theoretical perspective in Chapter Six ‘The Growth of Theory’ and through the analysis of data in Chapter Eight 'Attitudes: The Academic Perspective' and Chapter Nine 'Experience: The Institutional Perspective'.

## 5.4 The Teaching Technology Fit

It should be noted that, as with face-to-face methods, the particular mix and emphasis in the use of different processes mediated by learning technologies will vary. Particular technologies have particular affordances (Gaver, 1996, Crook and Webster, 1997, Light *et al.*, 1998, Hammond, 2004). The significance of these affordances will differ from subject to subject according to the demands and academic culture of the discipline and the resources available at the institution where the processes are taking place.

Critical factors for success (besides the selection of appropriate uses of technology) will be such items as the staff skills, technical support and the technological infrastructure available to support the learning (Hall and White, 1997). As has been noted, these are much the same as the set of key themes which belong to learning and teaching as a whole. If it is to be successful, technology has to be integrated into the wider processes associated with teaching and the support of student learning (Maier *et al.*, 1997).

## 5.5 Conclusions

This chapter examined ways in which different applications of learning technology can be classified. It demonstrates that there are a wide range of educational motivations for the use of technology in learning and teaching, and that the technology has become sufficiently sophisticated to support teaching across many different discipline areas.

Over time, the understanding of the affordances of technology has developed. It is beyond the scope of this study to consider the precise forms of uptake in detail across the Higher Education community. However it would seem clear that despite the long time availability of technology for learning and teaching and a succession of

projects to promote and support the use of technology across the curriculum the actual uptake is still not ubiquitous. Reasons for the achieved level of uptake may lie in a range of factors which include the managerial, social, educational and technological. Understanding the affordances of technology which is relevant to teaching and the support of learning can give an insight to the technology part of this equation. Technology affordances is one factor which needs to be revisited and analysed in the later chapters of this thesis which look at the growth of theory, the academic perspective and the institutional perspective.

In the next chapter this study will review existing theories on attitudes and approaches to organisational culture, change and innovation, both in general and with specific reference to technology in Higher Education.

# Chapter 6 The Growth of Theory

**This chapter examines theory which has emerged around the development of use in learning technology. A range of models are examined which reflect a growing understanding of the affordance of technological applications. Typically the models can be used to review or audit the state of existing applications, and provide the users with guidance as to effective practice.**

**A new model of analysing learning technology applications is proposed which analyses differing types of application according to the 'level of activity' which it affords.**

**Comparison is made between the potential of learning technologies to be used to deliver content with their role in supporting the learning process.**

## 6.1 Conversational Model of Learning

The variety of perspectives considering the potential of technology in learning have been presented in the preceding chapters. A model of learning which was specific to Higher Education was originally proposed by Laurillard in her 1993 publication 'Rethinking University Teaching: a Framework for the Effective Use of Educational Technology' illustrated in below(Figure 13). Laurillard's study discussed a range of application areas for learning technologies and made a significant contribution to the debate in the UK.

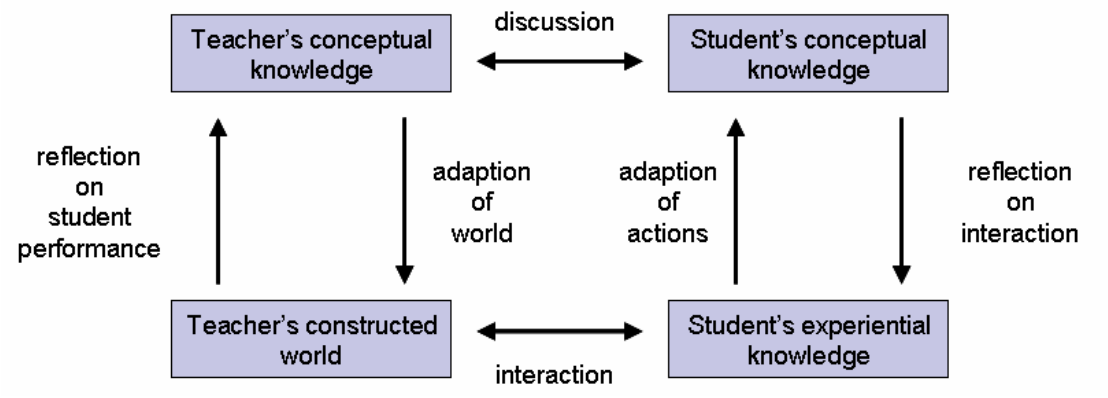



**Figure 13. The conversational model of learning (Laurillard, 1993)**

## 6.2 Primary, Secondary and Tertiary Courseware

Further contribution to the debate was made by Mayes who brought together consideration of software design, human computer interaction and models of learning including Kolb's Learning Cycle and Laurillard's conversational model (Mayes, 1995, Mayes and Neilson, 1995, Mayes and Fowler, 1999). His work specifically addressed issues associated with the design and use of courseware.

Mayes proposed a scheme for classifying courseware which he termed a re-conceptualisation cycle – as illustrated below (Figure 14) .

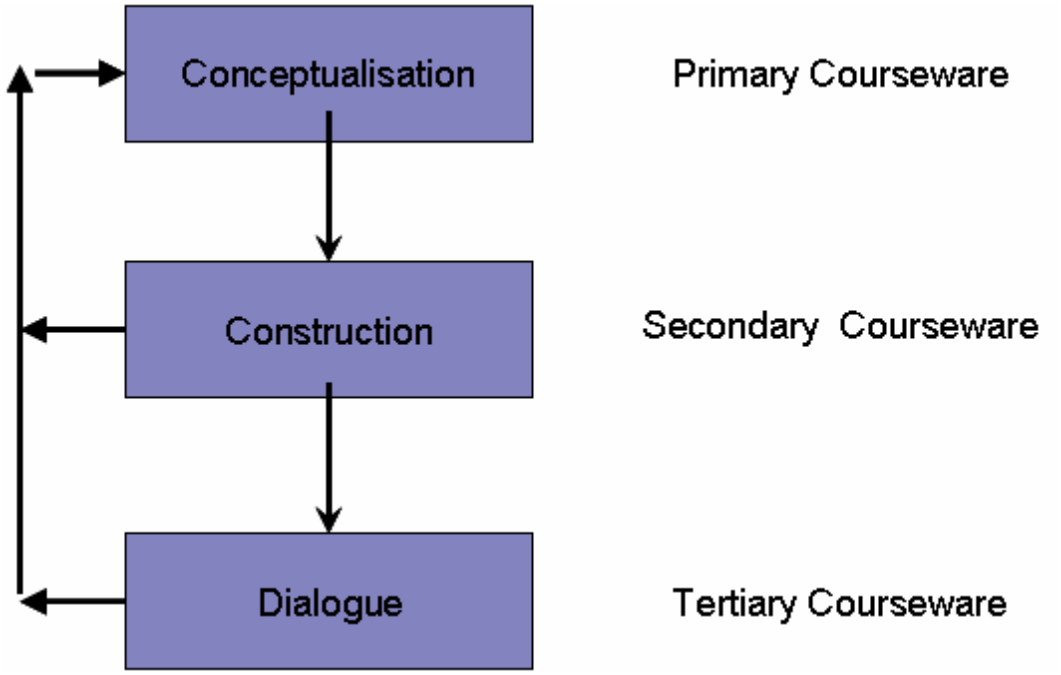



**Figure 14. Mayes (Re)conceptualisation of Learning Cycle (Mayes and Fowler, 1999)**

For Mayes, primary courseware provides computer-based access to subject-matter content. In the constructivist model, exposure to content alone is not sufficient to enable effective learning. Being aware of these limitations, developers of learning materials had adapted technology-based learning materials, deploying or designing applications which engaged learners in tasks. The learner would thus be involved in

building new cognitive constructs. Applications which work in this way can be termed secondary courseware.

There is however still a missing ingredient of dialogue. If courseware can integrate dialogues which involve discourse between learner and teacher or between peers and these dialogues can be integrated in some re-useable way, then we would produce what Mayes termed tertiary courseware.

## 6.3 Building Blocks of an Ideal Environment

Although concerned with similar objectives, Collins Brown and Newman proposed a rather different approach to assembling an effective electronic learning environment (Collins et al., 1989) . Using the idea of a cognitive apprenticeship as a model for learning they offered a more practical checklist rather than the basic theoretical model. They identified four building blocks of their ideal learning environment. The analytical dialogue below can be used to identify the appropriate components of that environment.

### 6.3.1 Content

Are computers being used to deliver materials in a way which may be of special benefit to the teacher? For example electronic notes may be preferred because it allows boring material to be presented without demanding teacher intervention. The use of electronic collections means that the resources are always available in the collection and cannot be unavailable because they have been borrowed or lost from the collection. Is access via an electronic proxy the only means which enables the learner almost first hand experience of a resource? Access might otherwise be impossible because of factors such as geography, security, or the rare and fragile nature of the primary source.

### 6.3.2 Method

In this context we might ask: “what is important?” Does a particular program enhance the quality of learning? Electronic presentation of the course materials may be useful to the learner, providing them an opportunity to study independently in their own time, space, or pace. Does electronic publication increase the ability of an institution to exert quality control on the production or delivery of materials? Does the system

overcome operational barriers? One of the drivers which has moved many users away from closed turnkey authoring systems towards a different style of delivery via the WWW, has been the ability of materials developed for the Web to be accessed on many different hardware platforms.

### 6.3.3 Sequence

It is additionally advantageous to the learner to be able to cut and paste between presented material and their own course work. Does the use of electronic delivery enable complementary materials to be presented side by side? An advantage of hypermedia systems is that they can be used to integrate different activities alongside the presentation of material, so that the learner is presented with knowledge and process in context, rather than separately. The use of hypermedia may also add the ability to search across the resource collection in a manner simply not possible in paper based or non-integrated materials.

### 6.3.4 Sociology

Is there a need to address organisational cost drivers which demand a consolidation of a range of courses? In some instances programs with the lowest level of interactivity, those which merely present information, may become widespread and much used because there are strong drivers for their use which come from both the learners and the educators.

## 6.4 Good Practice Benchmark Questions

An alternative means of review examines applications in terms of whether appropriate use of technology has been suggested. This is a set of benchmark questions identified by Alexander and Blight in their model of good practice for technology in education judgement (Alexander and Blight, 1996). They examine context, content, IT, learning strategies and design, teaching strategy, learning and assessment methods.

Their review method consists of a set of questions:

- What is the context of learning?
- Does the technology serve the learners in a special way?
- What is the content of learning?

Implicit in these questions is the assumption that the technology may be particularly effective (and better than other media) for delivering the content.

However it leaves open a number of questions about information technology. Does the technology support the most suitable learning design for the chosen content? In terms of IT is the choice of technology a viable option in the chosen context and does it enable the most appropriate learning strategies to be used for that particular content, for the target group of learners? In terms of learning and teaching design, what kinds of learning experiences are made possible by the use of technology and can the associated and appropriate teaching strategies, learning methods and assessment methods be supported by the technology?

## 6.5 Seven Principles and the Flashlight Program

How to improve undergraduate education and the principles of good practice were the focus of considerable discussion within US Department of Education report 'Involvement in Learning' (National Institute of Education, 1984). They were subsequently articulated as a statement of seven principles through an influential article in Bulletin of the American Association for Higher Education (Chickering and Gamson, 1987).

The seven principles swept the US and were applied to the context of educational technology within the Flashlight Program (Chickering and Ehrmann, 1996).

Chickering and Ehrmann presented a reflection and development of the original ideas in their article for Change magazine entitled 'Implementing The Seven Principles: Technology as Lever' summarised below (Figure 15)

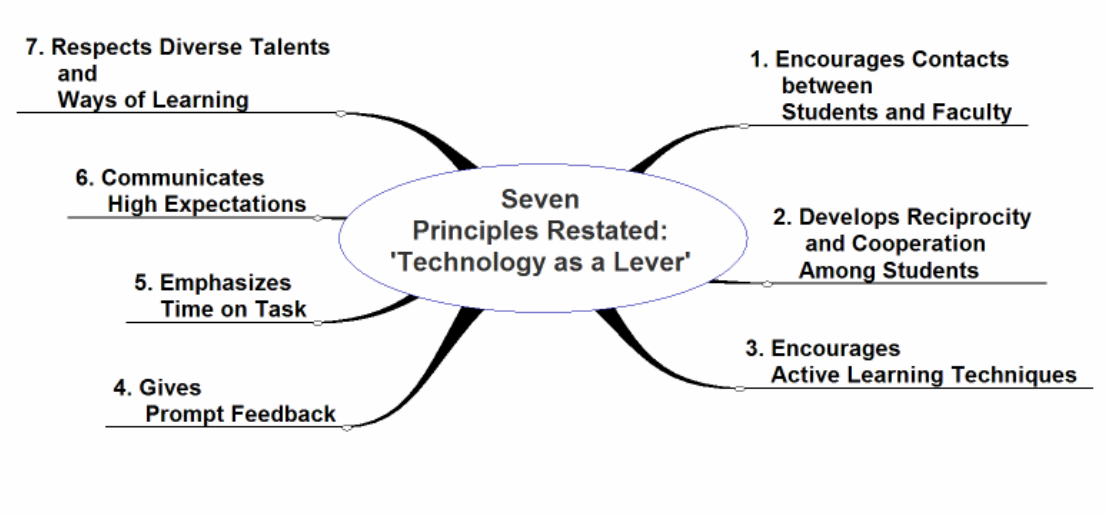



**Figure 15. Mindmap Summarising The Seven Principles of Good Practice in Undergraduate Education Restated in Technology as a Lever (Chickering and Ehrmann, 1996)**

The Paper described…

> *"…some of the most cost-effective and appropriate ways to use computers, video, and telecommunications technologies to advance the Seven Principles"*
>
> (Chickering and Ehrmann, 1996)

## 6.6 Courseware Activity Gradient

The model of an activity gradient (Figure 16) was developed by the author as part of her work with the Scholar Project. The gradient is designed to contribute to the review or development of existing learning technology resources (courseware). It was used to assist the process of communicating with academics at the University of Southampton (Hall *et al.*, 1999).

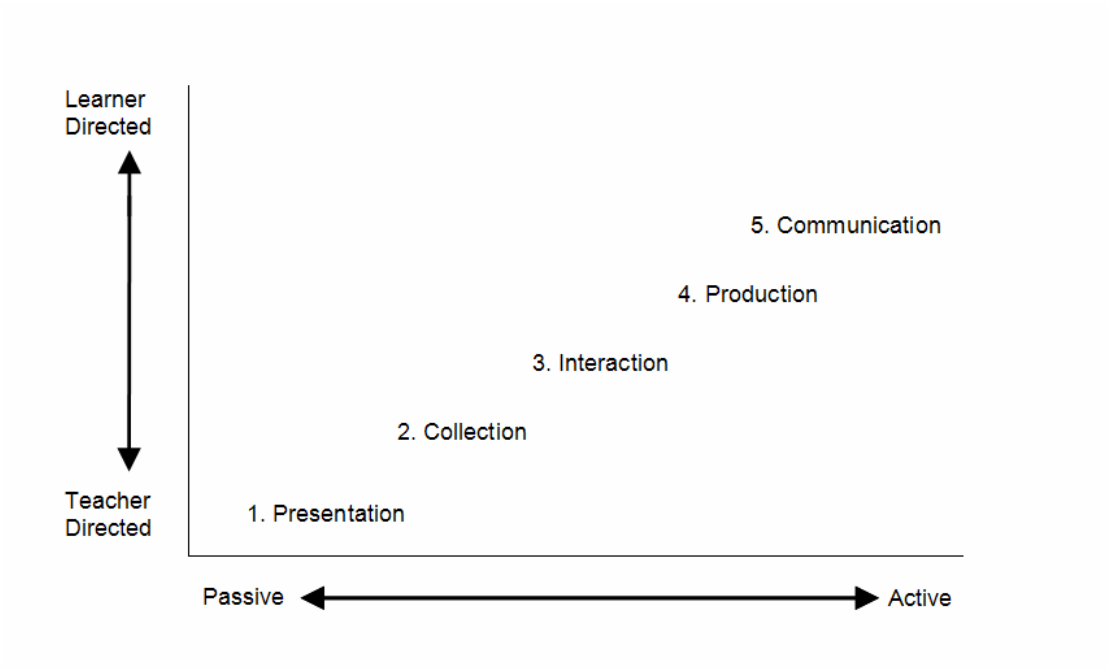



**Figure 16. The Activity Gradient**

It can be regarded as an elaboration of the concepts of primary, secondary and tertiary courseware originally developed by Terry Mayes (Mayes, 1995, Mayes and Neilson, 1995, Mayes and Fowler, 1999). Unlike the Laurillard and Mayes models, it does not claim to represent the processes which take place during learning. Like the building blocks of an ideal environment, the good practice benchmark questions, and the Seven Principles as adopted by the Flashlight Program, it does provide a tool for academics to use as a checklist of their learning technology application. It can also be seen as a device for making explicit the functions of the affordances of various types of learning technologies.

The figure shown below (Figure 17) illustrates examples of the different levels of interactivity which can be achieved, although in real life it is most likely that the examples will incorporate a range of styles of interactivity around a core style. Interactivity which can be attained through the use of learning technologies can range across five discreet stages.

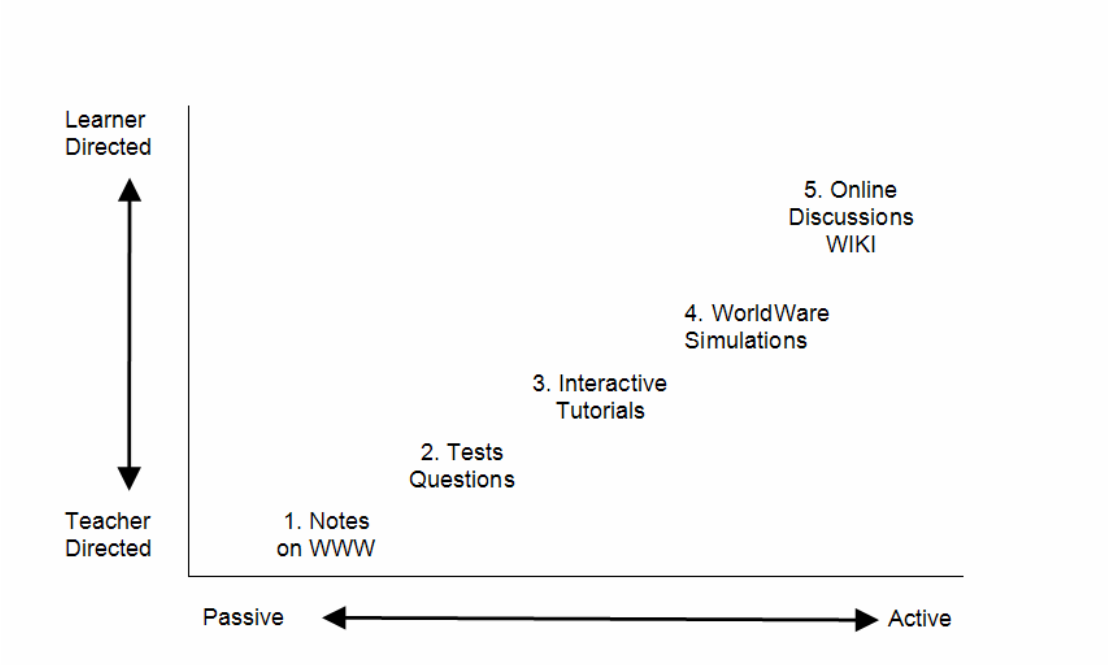



**Figure 17. The Activity Gradient with examples of learning activities**

### 6.6.1 Presentation

In the first stage components are concerned solely with content. A typical example is using technology to present static information in text, graphics. Each subsequent stage introduces increasing levels of interactivity. Components are predominantly teacher directed at stage one, at stage five they are predominantly learner directed or student centred.

### 6.6.2 Collection

In the second stage greater interactivity is attained through simple tasks which extend the presentations of Stage One. Questions might be inserted into textual accounts, prompting the learner to question and reflect. Introducing assessments which are evaluated for formative or diagnostic purpose can formalise this feedback loop to the learner, for example providing feedback on the knowledge, understanding and recall.

### 6.6.3 Interaction

At the third stage greater interactivity is introduced by using technology to frame tasks for the learner. Thus we might require the learner to manipulate a real tool in order to obtain information. For example they might execute a database query or undertake an online search. In science they might use a simulation of an experiment. In this instance the teacher is defining the extent of the world or universe rather than explicitly providing the content of that world. The learner's interaction in a simulation is constrained by the conditions or parameters of the "microworld" as defined by the program (Papert, 1980). Searching through a single database, set of databases, or a restricted Internet domain takes place in a closed world. Searching the open Internet takes place in an open world, where the learner might run the risk of becoming "lost in hyperspace" (Edwards and Hardman, 1989).

### 6.6.4 Production

The fourth stage involves creation or composition. For example the learner may make use of mathematical/graphical modelling programs or create hypermedia. If learners use software to construct a model or produce a piece of hypermedia they are in fact determining their own limits of the world moderated by guidelines provided by the teacher (Mellar and Bliss, 1993). In both these instances the learning outcomes may be defined by traditional teaching methods, but the program acts as an integrator, providing the framework within which to assemble and integrate the acquisition of content knowledge situated in context (Brown *et al.*, 1989) with the development and practice of real world IT skills.

### 6.6.5 Communication

The greatest level of interactivity and learner control is achieved by adding dialogue in the fifth stage. An example of such interactivity in its most closed form is as the feedback and pre-programmed discussions which are generated within interactive tutorial systems (Ambron and Hooper, 1990).

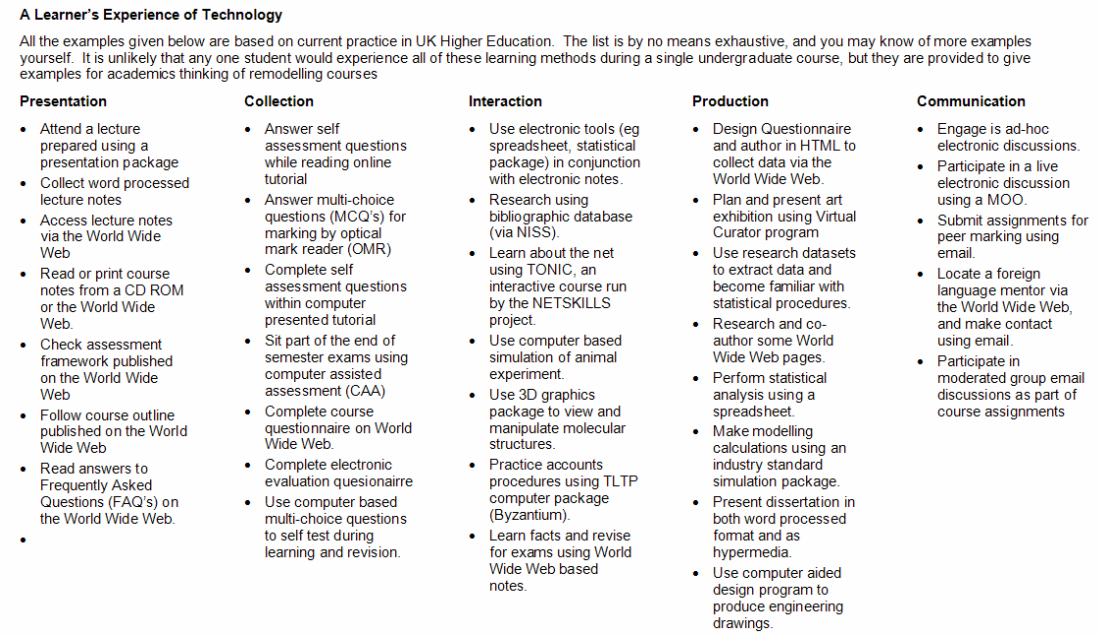
Use of networked computers to support computer mediated communications can be used to create engaging forms of interactivity using methods which are less developmentally intensive than those required by interactive tutorials (Hiltz, 1994).

Thus in engaging is tutor moderated peer discussion, students experience a dynamic but highly effective tutorial in which they play a part as creators (Light et al., 1997).

Another example is to provide access to frequently asked questions (FAQs) in the style of an Answer Garden (Ackerman and Malone, 1990, Brailsford et al., 1997). This is less open than the use of external teacher directed participation into a closed, peer (Intranet) electronic discussion group.

The least constrained form of interaction is achieved through free participation in an open (Internet) based electronic discussion group (Bates, 1994, Duffy et al., 1995a, Collis, 1996, Bonk and King, 1998, Lea, 1999).

Whatever the method, these examples are at the highly interactive end of the gradient, providing the learner with the opportunity to process, reflect upon and interact with information, organise, analyse and synthesise knowledge and understanding rather than simply memorising or 'learning' a set of facts. Examples of the various types of software and levels of interactivity are shown below (Figure 18).



**A Learner's Experience of Technology**

All the examples given below are based on current practice in UK Higher Education. The list is by no means exhaustive, and you may know of more examples yourself. It is unlikely that any one student would experience all of these learning methods during a single undergraduate course, but they are provided to give examples for academics thinking of remodelling courses

**Presentation**

- Attend a lecture prepared using a presentation package
- Collect word processed lecture notes
- Access lecture notes via the World Wide Web
- Read or print course notes from a CD ROM or the World Wide Web.
- Check assessment framework published on the World Wide Web
- Follow course outline published on the World Wide Web
- Read answers to Frequently Asked Questions (FAQ's) on the World Wide Web.

**Collection**

- Answer self assessment questions while reading online tutorial
- Answer multi-choice questions (MCQ's) for marking by optical mark reader (OMR)
- Complete self assessment questions within computer presented tutorial
- Sit part of the end of semester exams using computer assisted assessment (CAA)
- Complete course questionnaire on World Wide Web.
- Complete electronic evaluation quesionairre
- Use computer based multi-choice questions to self test during learning and revision.

**Interaction**

- Use electronic tools (eg spreadsheet, statistical package) in conjunction with electronic notes.
- Research using bibliographic database (via NISS).
- Learn about the net using TONIC, an interactive course run by the NETSKILLS project.
- Use computer based simulation of animal experiment.
- Use 3D graphics package to view and manipulate molecular structures.
- Practice accounts procedures using TLTP computer package (Byzantium).
- Learn facts and revise for exams using World Wide Web based notes.

**Production**

- Design Questionnaire and author in HTML to collect data via the World Wide Web.
- Plan and present art exhibition using Virtual Curator program
- Use research datasets to extract data and become familiar with statistical procedures.
- Research and co-author some World Wide Web pages.
- Perform statistical analysis using a spreadsheet.
- Make modelling calculations using an industry standard simulation package.
- Present dissertation in both word processed format and as hypermedia.
- Use computer aided design program to produce engineering drawings.

**Communication**

- Engage is ad-hoc electronic discussions.
- Participate in a live electronic discussion using a MOO.
- Submit assignments for peer marking using email.
- Locate a foreign language mentor via the World Wide Web, and make contact using email.
- Participate in moderated group email discussions as part of course assignments

**Figure 18. The Activity Gradient - showing a learner's experience of technology**

## 6.7 Conclusions

This chapter examined ways in which different applications of learning technology can be classified. It demonstrates that there are a wide range of educational motivations for the use of technology in learning and teaching, and that the technology has become sufficiently sophisticated to support teaching across many different discipline areas. Over time, the understanding of the affordances of technology has developed.

It is beyond the scope of this study to consider the precise forms of uptake in detail across the Higher Education community. However it would seem clear that despite the availability of technology for learning and teaching for a long period of time, and a succession of projects to promote and support the use of technology across the curriculum the actual uptake is still not ubiquitous. In the next chapter this study will review existing theories on attitudes and approaches to change and innovation, both in general and with specific reference to technology in Higher Education.

# Chapter 7 Change and Innovation

*"There is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage than the creation of a new system. For the initiator has the enmity of all who would profit by the preservation of the old system and merely lukewarm defenders in those who should gain by the new one"*

Nicollo Machiavelli The Prince (Machiavelli, [1532] 1981)

**This chapter reviews theories of change, innovation and organisational structure and culture. It then goes on to review the historical uptake of learning technology in the context of those theories. The changes observed in this study with respect to the use of technology in education have so far been tracked crudely against the background influences of an accelerating technological base, falls in the real costs of technological infrastructure, and ongoing developments of models of understanding of the learning process as theorised and investigated by educationalists and psychologists.**

**An understanding of such processes can also be usefully set in the context of current understanding of the mechanisms which underlie, and may drive or undermine, any conscious intervention to introduce change. This chapter therefore provides an opportunity to consider in detail the threads of organisation, structure, culture and climate introduced in Chapter Two 'Research Methods'.**

## 7.1 Educational Change and Organisational Culture

The literature on change is extensive. In the context of the introduction of innovations Rogers initially developed key views on the motivations, uptake and implementation of new methods (Rogers, 1983b). His perspectives have been taken forward in the context of technological, organisational and educational change by authors such as Moore, Senge and Geoghegan (Senge, 1990, Moore, 1991, Geoghegan, 1994a, 1994b, Geoghegan, 1996b, Geoghegan, 1998).

### 7.1.1 Educational Change

Fullan wrote on educational change bringing together the perspectives of business organisation and schooling in the USA (Fullan, 2001). He stressed that cultural change must be led. He noted that the common organisational response to the need for change was to reorganise. He argued that whilst structure would make a difference, changing by "transforming the culture" was a means of not only adopting innovations but also "producing the capacity to seek, critically assess and selectively incorporate new ideas and practices". He termed this approach "re-culturing".

### 7.1.2 Organisational Culture

Handy has published extensively on organisations, and his concepts of the "Four Gods of Management" (Handy, 1985). He typified four types of organisation, styling them after Greek Gods. Fowler and Gilfillan carried out detailed research into Stakeholder Integration in Higher Education Information Systems (Fowler and Gilfillan, 2003). They considered that UK Higher Education was most closely associated with **Dionysus**. Their understandings are summarised in the diagram below (Figure 19)

| Culture | God | Characteristics | |
|---|---|---|---|
| Power | Zeus | Focused on a single leader, autocratic style,<br>Loose structure<br>Dynamic and entrepreneurial | |
| Role | Apollo | Focussed on individual specialism<br>Formalised, rule based<br>Stable and Predictable | |
| Task | Athena | Group gathered with common purpose<br>Creative Dynamic<br>Task Oriented | Classic Project Management Orientation |
| Existential (personal) | Dionysus | Shared resources<br>but people not dependant on each other<br>Self determination<br>Loose Structure | Traditional University Culture |

**Figure 19. Four Gods of Management (Handy, 1995)**

### 7.1.3 Academic Culture

Concepts of culture in academia have been explored by Austin (Austin, 1990), and The cultures of the academy were specifically studied by Bergquist in his book The Four Cultures of the Academy (Bergquist, 1992).

Studies of organisational change and culture in the specific context of Higher Education have been undertaken in the United States (Kezar, 2001, Kezar and Eckel, 2002, Eckel and Kezar, 2003). This work follows through approaches initially suggested by Peterson and Spencer, and Bergquist recognising the value of taking context into account when trying to analyse the likely direction of organisational change within Higher Education (Peterson and Spencer, 1991, Bergquist, 1992) whose work.

The specific context of change in UK Higher Education has been studied extensively by McNay (McNay, 1995, McNay, 1997, McNay, 2000). Allen has undertaking work where the approach takes a contextual analysis similar to that suggested by Eckel and Kezar (Allen, 2003).

At the University of Southampton, the activities of the Scholar Project (White, 1997) provided a starting point against which to gauge these theories for further examination on a wider UK basis. This work was discussed in further detail in Chapter 3 ‘Technologies Retrospective’.

## 7.2 Moore’s Chasm

Moore categorised users of new technology into a number of distinct areas. Building on Roger’s original work, he examined the uptake in sunrise industries in West Coast USA (Moore, 1991). He typified users as falling into categories of Early Adopters, Early Majority, Late Majority and Late Adopter with a distribution as illustrated below (Figure 20).

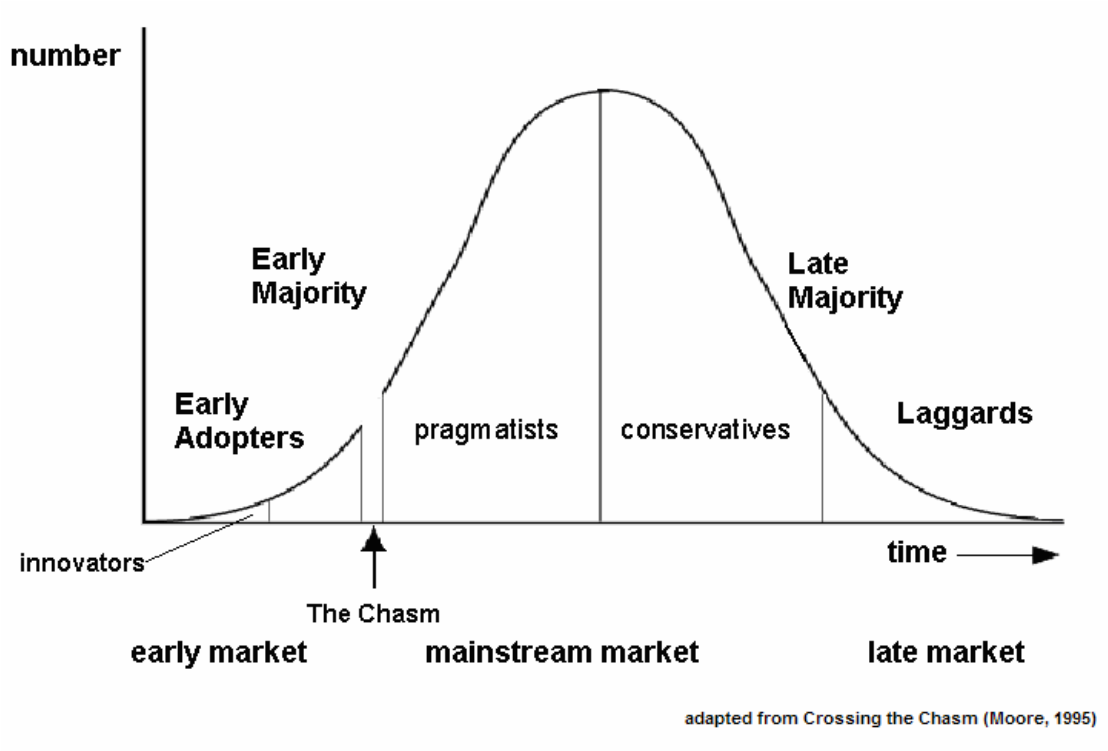



**Figure 20. Locating the Chasm (Moore, 1995)**

Moore noted that systems which were judged to be successful had common features which enabled the extent of their use to jump across the “chasm” between the early adopters and the early majority.

How to extend the use of technology for teaching and learning from the early adopter to the early majority is one of the biggest challenges which faces HE is this area. Large numbers of new initiatives and methods have been embarked upon over time, and yet widespread institutional use of computer based systems in the context of learning and teaching has appeared to be elusive. Geoghegan, whose approach is compatible with earlier observations by Stern & Keislar (Stern and Keislar, 1977) usefully discussed the issues of implementing learning technologies in his paper Whatever Happened to Instructional Technology (Geoghegan, 1994b). He extended Moore’s observation to users of learning technologies, and compared the needs and affiliations of the early adopters and the early majority with the objective of identifying their differing requirements of new technology. Those needs or requirements can be summarised as shown below (Table 1)

**Table 1. Early Adopters vs. Early Majority (Geoghegan, 1995)**

| Early Adopters | Early Majority |
|---|---|
| • like radical change<br>• visionary<br>• project oriented<br>• risk takers<br>• experimenters<br>• self sufficient<br>• relate horizontally | • like gradual change<br>• pragmatic<br>• process oriented<br>• risk averse<br>• seek proven uses<br>• need support<br>• relate vertically |

## 7.3 Technology and the Chasm in the UK

It is interesting to consider the UK learning technologies experience in the light of Geoghegan's observations. In the UK the Higher Education Funding Councils sought to stimulate the use of learning technology through the Teaching and Learning Technology Programme. Projects which were active under the TLTP programme, operated amongst the early adopters (HEFCE, 1996, Hall and White, 1997). The aim of the programme was to achieve radical change and there was a visionary aspect to the initial objectives at both a programme and individual project level. In terms of Geoghegan's classification, the programme was certainly project oriented and by virtue of the competitive nature of the funding mechanism, might well be seen as attracting risk takers. Many projects were expressly experimental, developers often self sufficient and frequently related horizontally to other enthusiasts and early adopters amongst their teaching and learning technology peers, rather that vertically to a broader range of their academic colleagues within their institutions.

By contrast subsequent initiatives such as the Fund for the Dissemination of Learning and Teaching (FDTL), Teaching and Learning Technology Support Network (TLTSN), and the Teaching and Learning Support Network (LTSN), focussed their activities in the areas associated with the early majority (Tucker, 1996, Tucker, 1997, HEFCE, 1998a).

Policy initiatives related to changes in learning and teaching instigated in the UK at the end of the 1990s specified approaches designed to work with the early majority. FDTL projects worked vertically across subject disciplines and were specifically

required to build upon and disseminate existing good practice. The work of the LTSN centres was designed to address gradual change and perform the role of knowledge brokers supporting activities such as the production and dissemination of good practice through the use of case studies.

Various publications were targeted at specific academic roles, or took a practical approach of "guides for busy academics"(Barnett *et al.*, 1996, Harvey, 1998, White, 1999). In these cases the publications demonstrated proven uses and examples of pragmatic approaches to change. Many of the consultative areas, such as the focus of student learning, or creating learning and teaching strategies or preparing for quality audits, were process rather than project oriented. The clients were recognised as needing support, for which the networks had been expressly established. Finally they motivated institutional approaches which focussed on core learning and teaching processes (for example assessment, student project work) which could be related vertically within an institution rather than being of relevance predominantly to enthusiasts and early adopters.

Analysis at this level is difficult to find. Although there is much in the learning technologies literature which relates to the introduction of various different forms of technology (see Chapter 3 'Technologies Retrospective'), there has been relatively little which focussed specifically on the complex inter-relationship between technology, institutions and change.

Many of the authors who have addressed this area have looked at specific limited contexts. For example among the pundits there has emerged a strong belief that developments in the use of learning technologies threaten to challenge the future of the traditional campus based university (Noam, 1995, Angell, 1998). Allen and Fifield critique business process re-engineering as a change management strategy in Higher Education. (Allen and Fifield, 1999). It is possible to find discussion of the potential impact of large scale use of learning technologies, however these have most frequently taken applications in distance learning as the starting point (Daniel, 1996, Bates, 1997, Marchese, 1998, Newby, 1999). In the UK MacFarlane, who was a strong influence on the shaping of the original TLTP programme, was one author who did discuss learning technologies in the context of traditional campus based Higher Education Institution (MacFarlane, 1992). More recently Beaty et al provided

an account of the experience at Coventry University (Beaty *et al.*, 2002).

## 7.4 Institutional Organisation in UK Higher Education

Geoghegan's perspective on change looked at the motivations which would affect an individual within an organisation. Another possible perspective is via motivations which will be inherent in the institution's organisational structure.

McNay has spent some time looking at differing organisational models which predominate in Higher Education (McNay, 1995). He identified four broad types of organisation in Higher Education; collegial, corporate, enterprise and bureaucratic, as illustrated below (Figure 21).

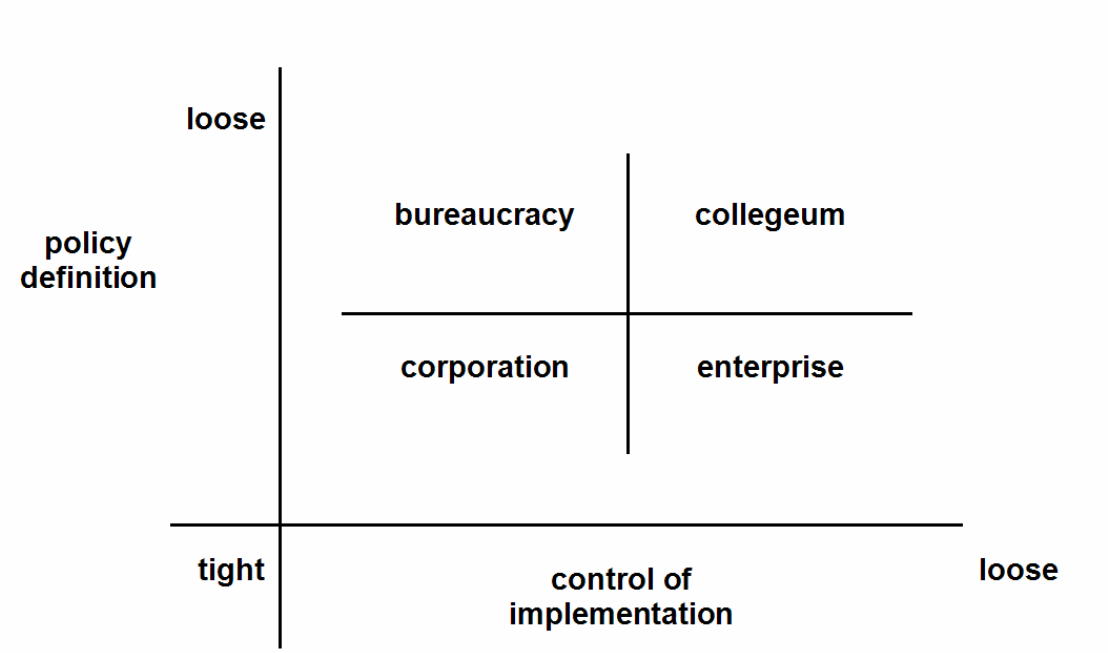



**Figure 21. The Four Cultures of the University (McNay, 1995)**

It seems reasonable to assert that the type of organisational model which predominates in a given higher education institution will have an impact on the way in which change might come about in that institution. The differentiation and categorisation of institutions suggested by McNay is useful for an analytical purpose because of its limited range of options.. There is clear evidence of pluralism in UK

Higher Education, Scott identified 16 different institutional types (Scott, 1995). The profile of institutions has changed a little since Scott's observations were first made the diversity but points to a far more complex set of possibilities than is reflected in McNay's model. Indeed McNay agrees that institutions will exhibit features of more that one type. The importance of his model lies in the way in which predominant and typical behaviours can be identified. Predominant behaviours can in their turn suggest predominant institutional motivations for change, and also likely barriers to change. If the most likely behaviour of an institution can be anticipated, then ways of utilising that behaviour can be devised. Similarly ways can be devised of overcoming the anticipated barriers to change which may arise as a consequence of typical behaviours. Specific behaviours which might be expected to arise in the four institution types are described below and summarised in the diagram (Figure 22).

### 7.4.1 Collegial

In a 'collegial' institution both control of implementation and policy definition are loose. Academic autonomy is relatively high.

It would be expected that such autonomy might be present in administrative and teaching practices as well as in the area of academic research. Under such circumstances one might expect to discover a wide range of uses of learning technology.

It would be surprising to find any particular technology to be the chosen standard, and even if that were the case, the adherence to such a standard might be low.

### 7.4l2 Enterprise

In an 'enterprise' institution policy definition are tighter than in the collegial institution, although control of implementation will remain loose.

Under such conditions one might expect a coherent sense of purpose with respect to teaching objectives and the use of learning technologies, however again it would be surprising to find any particular technology to be the chosen standard, and even if that were the case the adherence to such a standard might be low.

### 7.4l3 Bureaucratic

In the ‘bureaucratic’ institution policy definition is loose, but control of implementation is tight.

One might expect the clear sense of purpose and objective with respect to teaching and learning technologies to be less well defined, while the specification of technology platform and appropriate software use to be well defined with widespread adherence to the standard.

### 7.4l4 Corporate

In the ‘corporate’ institution both policy definition and control of implementation is tight.

Under such conditions one might expect to find evidence of a clear sense of purpose and objectives with respect to teaching, and learning technologies. Similarly a clear specification of technology platforms and appropriate software might be found.

It is possible to consider how these constraints might be reflected in the practices associated with learning and teaching, and the application of these practices in the use of learning technologies. Suggested consequences, the possible impact of organisational structure on learning technology uptake is shown below.

| Organisational Type | Policy Definition | | Control of Implementation | |
|---|---|---|---|---|
| | Loose | Tight | Loose | Tight |
| Collegial | High academic autonomy in learning and teaching | | Wide range and variety of software use and approaches | |
| Enterprise | | Clear sense of purpose for teaching and use of learning technologies | Wide range and variety of software use and approaches ++ | |
| Bureaucratic | Diffuse sense of purpose for teaching and use of learning technologies | | | Limited range of standard software and learning technology approaches |
| Corporate | | Clear sense of purpose for teaching and use of learning technologies | | Limited range of standard software and learning technology approaches++ |

**Figure 22. The Four Cultures of the University and Learning Technologies**

## 7.5 Mixing the Models

McNay acknowledged that institutions would exhibit overlaps of the different of institutional type. This is confirmed in Henkel's discussion of organisational models in Higher Education focussed on issues associated with quality which acknowledges that institutions frequently exhibit characteristics of more than one organisational type (Henkel, 1997). That assertion does not exclude the possibility of applying this model, it does however make possible use of the model rather more complex.

It is also possible to analyse institutional change from the individual perspective offered by Geoghegan alongside McNay's organisational approach. In any given institution, an individual academic's view and experience of the various factors which may predispose them to make use of available learning technologies will be coloured by the institutional context in which they exist. In this case it should be possible to

consider technologies in the context of their fit to the predominant institutional climate, and then in the context of the general observations offered by Geoghegan.

In order to consider if it is worth following through these assertions, I will examine the context of one institution of which I have experience, and for which I have some data. The motivating focus in this original study was the experience of the University of Southampton which is a research intensive university with a highly devolved organisational structure and a high level of departmental and academic autonomy. Details of the study are provided in Chapter 8 'Attitudes: The Academic Perspective'. There was a small amount of central institutional support for the development of teaching approaches, and the use of learning technologies. On the grid defined by McNay, it would be predominantly collegial (particularly in the context of learning and teaching) although there was some drift towards policy definition and control of implementation through a managerial superstructure.

Within the University of Southampton, the Scholar Project was to some extent operating as an enterprise organisation, but the work of the project was a small part of the activity across the university as a whole.

Reflection on the organisational difference between institutions might produce evidence that different styles of institution with differing missions and long standing management structures might have differing places on the McNay grid, and differing experiences with the implementation and use of learning technologies. Some observers have expressed views which might be considered in this context. Graham Gibbs in his article Changes in Development, stated:

> *"The recent avalanche of funding for and interest in the uses of IT in teaching and learning has barely rippled the surface of the lives of most students. Within such standard frameworks, the improvement of teaching has largely been an individual or even individualistic pursuit. Time and time again we are seeing that the full integration of IT cannot take place without the commitment of the department and the institution."*
>
> (Gibbs, 1996)

David Albury in a presentation during the Oxford Brookes IT Term stated that technological change presupposes an organisational change with the whole

institution needing to clarify its position regarding technology and with an enabling framework required from senior management (Tucker, 1997).

## 7.6 Conclusions

This chapter has examined theories and attitudes to culture, change and innovation. It has also considered the role of organisational models of Higher Education institutions in terms of their ability to inhibit or encourage change and innovation in educational practices. It has been noted in previous chapters that there is much in the learning technologies literature which relates to the introduction of various different forms of technology. However there has been relatively little analysis which focussed specifically on the complex inter-relationship between organisational culture learning technologies, institutions and change. It is clear that this is an area of study for which there can be fruitful further research.

The next chapter describes the methodology adopted when undertaking an extensive survey of use of learning technology at the University of Southampton and then analyses this data alongside a range of previously published data to make an initial case that institutional approaches associated with the known organisational models may amplify or dampen the known barriers and drivers for change.

# Chapter 8 Attitudes: The Academic Perspective

**This chapter describes the methodology used for an extensive survey of use of learning technology at the University of Southampton. This followed on from two previous surveys at the start and end points of the TLTP Scholar Project in 1993 and 1996. All three surveys followed the same question structure in order to provide comparative data. This chapter summarises the main findings of the 2000 survey, but where appropriate, reference is also made to previous surveys. The author led the team which designed the format of the original survey. The 1993 and 1996 surveys were delivered and originally analysed by other academic colleagues (Barnett et al., 1998); comparative analysis of all three returns has been carried out by the author. This chapter analyses the combined data to make an initial case that institutional approaches associated with the known organisational models may amplify or dampen the known barriers and drivers for change.**

## 8.1 The Scholar Project

The TLTP Scholar Project was a three year TLTP Institutional Project (see Chapter 5 Learning Technologies in the UK) begun in 1993 and run at the University of Southampton. It built on expertise in the department of Electronics and Computer Science, coupled with commitment and infrastructure provided by three central university departments; Teaching Support and Media Services, Computing Service and The Library. The project proposal was written before the wide use of the World Wide Web and aimed to make use of the then recently developed Microcosm Open Hypermedia System (Hutchings *et al.*, 1994) to create sets of resources for academic use in teaching and learning across the university. This activity would be coupled with an extensive programme of staff and educational development activity to provide a focus for institutional change through the integration of technology-based teaching across the university. The project had a remit to ”shift the culture of the University through the objective of establishing a ‘Campus Wide Structure for Multimedia Learning’".

## 8.2 Attitude surveys

In order to gauge the extent of change effected by the project and some understanding of the impact of the project's activity, three attitudinal surveys were conducted in 1993, 1996 and 2000.

The original format was based upon a survey conducted at Glasgow University by the TILT project which was another institutional initiative funded by TLTP (Doughty, 1994).The original TILT survey was widely disseminated and was adapted for use by a number of other UK Universities (Bailey, 1996).

### 8.2.1 Southampton's 2000 survey

At the beginning of 2000 a 14 section survey of staff use of computers was distributed to all academic, research and academic-related members of staff at the University of Southampton. The format of the survey was designed to gauge culture change across the University following on from the TLTP Scholar project. A copy of the survey questions is included in Appendix A. The data collected gives a picture of the then current state of staff skills and attitudes to the use of technology in teaching in the support of learning. It can also be used to provide some indication of how skills, usage and attitudes had moved forward in the University of Southampton over the previous seven years.

### 8.2.2 Aims

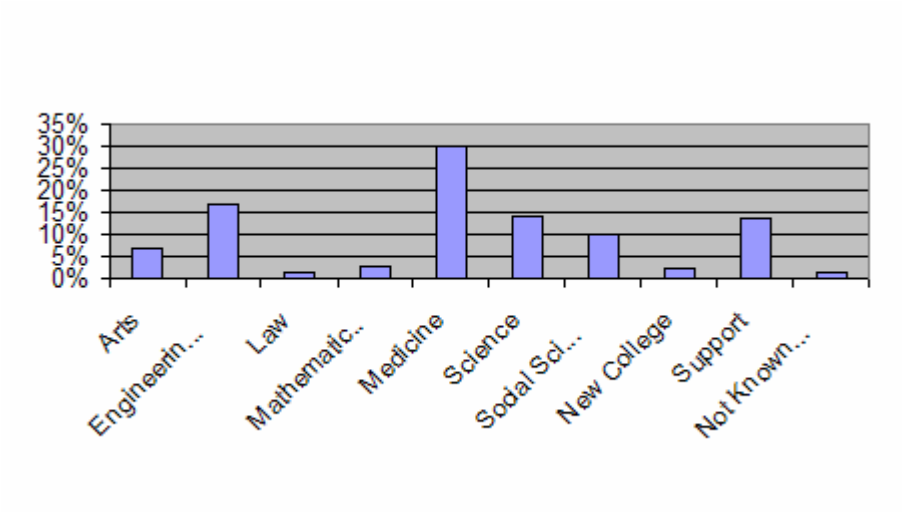
The questionnaire was designed to obtain information on the status of the use of teaching/learning resources within the university, with particular emphasis on the use of computers in teaching. Questions covered the following areas:

- General levels of competence in the use of computers
- The level of personal skills in the use of a range of software types
- The availability of computers at work and at home and via networks
- The use of different computer platforms and technologies in teaching
- Tutors' use of a variety of teaching materials/equipment
- Tutors' expectations of student use of computers
- Attitudes to adapting teaching materials to a computer environment
- Support needs of different groups of respondents

A copy of the questionnaire is included in Appendix A

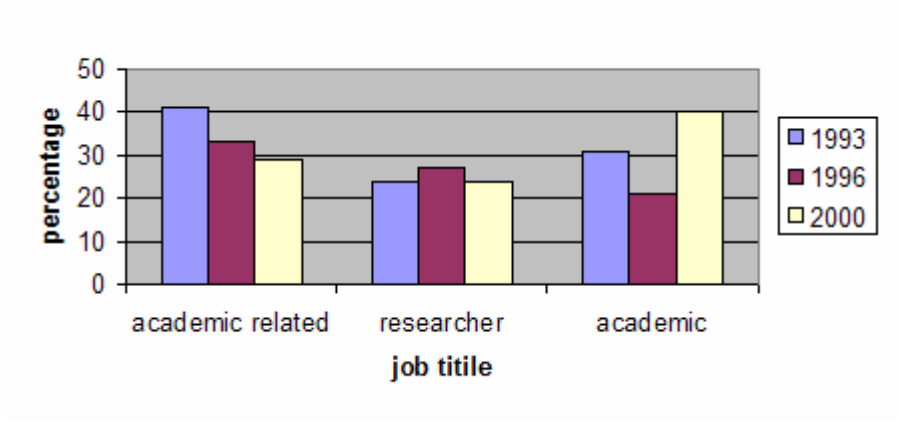
This sub section looks at the user profile of the respondents, their access to computers, faculty job category and computer experience. A total of 2,420 questionnaires were circulated in 2000, compared with around 1,800 questionnaires in each of the previous surveys. This change reflected the growth of the University which had incorporated two additional local institutions: New College (formerly La Sainte Union) and Winchester School of Art. A total of 1,026 questionnaires (42%) were returned in 2000 compared to 559 (31%) returned in 1993 and 690 (38%) returned in 1996. Of that number in 2000 more than 500 provided contact details and indicated that they would be interested in receiving further information on the subject. A breakdown of respondents by faculty is shown below (Table 2)

**Table 2. Respondents to the Scholar Survey, by faculty (2000)**




Subjects were asked to indicate their position in the university, broadly differentiated between categories of full-time academic, academic-related, or researcher (Table 3) . A small number of duplicate responses were caused by dual roles; however, 40% of respondents categorised themselves as full-time academic (including Deans and Heads of Department), a further 24% classed themselves as members of research staff, or students, and 29 percent responded as academic-related. A further 8% classed themselves as part-time, members of support staff, or did not give a reply.

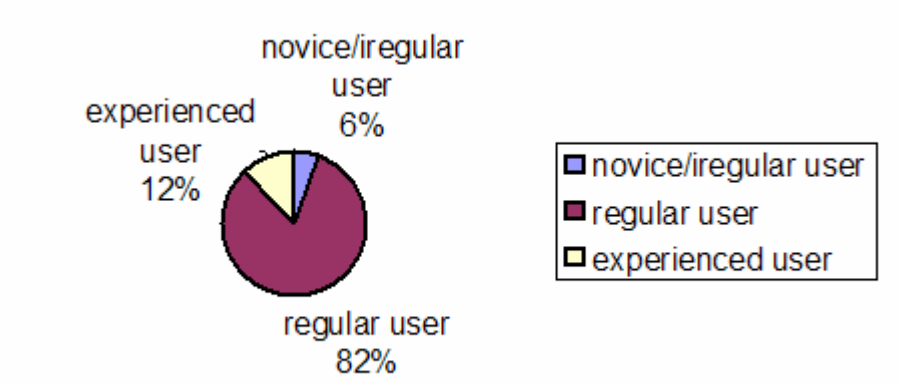
**Table 3. Respondents to the Scholar Survey, by job title (1993-2000)**




## 8.3.1 Respondents: Computer confidence

Question 1 was aimed at establishing computer confidence of members of staff at the University. People were asked to rate their experience on computers - as novice, regular user and experienced user (Table 4) .

**Table 4. Computer Confidence by Experience Rating (2000)**



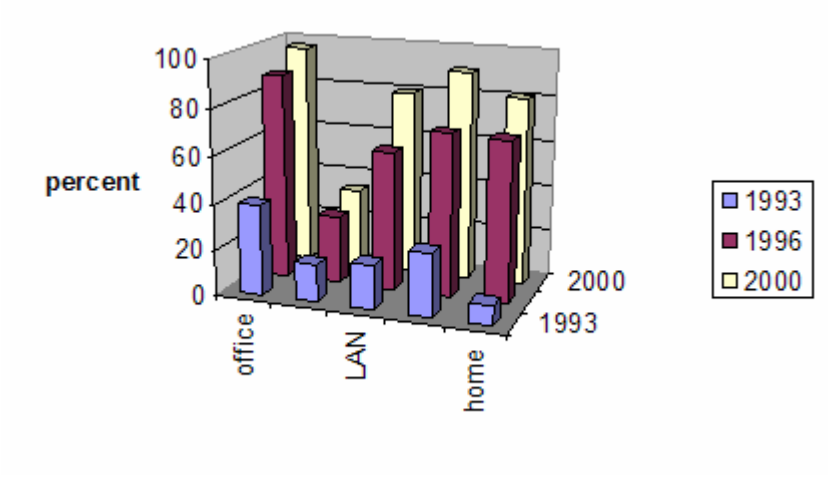

Compared with previous surveys there was a small fall in the novice and irregular users (originally 32% in 1993, falling to 10% in 1996 and 6% in 2000). Regular users remained at 82%, as they were in 1996 having grown from 54% in 1993. Experienced users originally rated at 14% in 1993, fell to 9% in 1996 and rose back

up to 12% in 2000. It should be acknowledged that those who classed themselves as a regular or experienced user may have been more likely to respond to a survey of this nature.

### 8.3.2 Respondents: Access to computers

Not surprisingly, access to computers has increased over the seven years (Table 5).

**Table 5. Change in access to computers over time (1993-2000)**




In 1993 only 39% of staff responding had computers in their offices, compared to 89% in 1996 and 97% in 2000. Access to a LAN and the campus network had increased to around 90% although 7% of respondents reported that they had no access from their computer to the campus network. Access to a home computer had increased dramatically from 8.5% in 1993, to 69% in 1996 and 80% in 2000.

## 8.4 Technology and Teaching

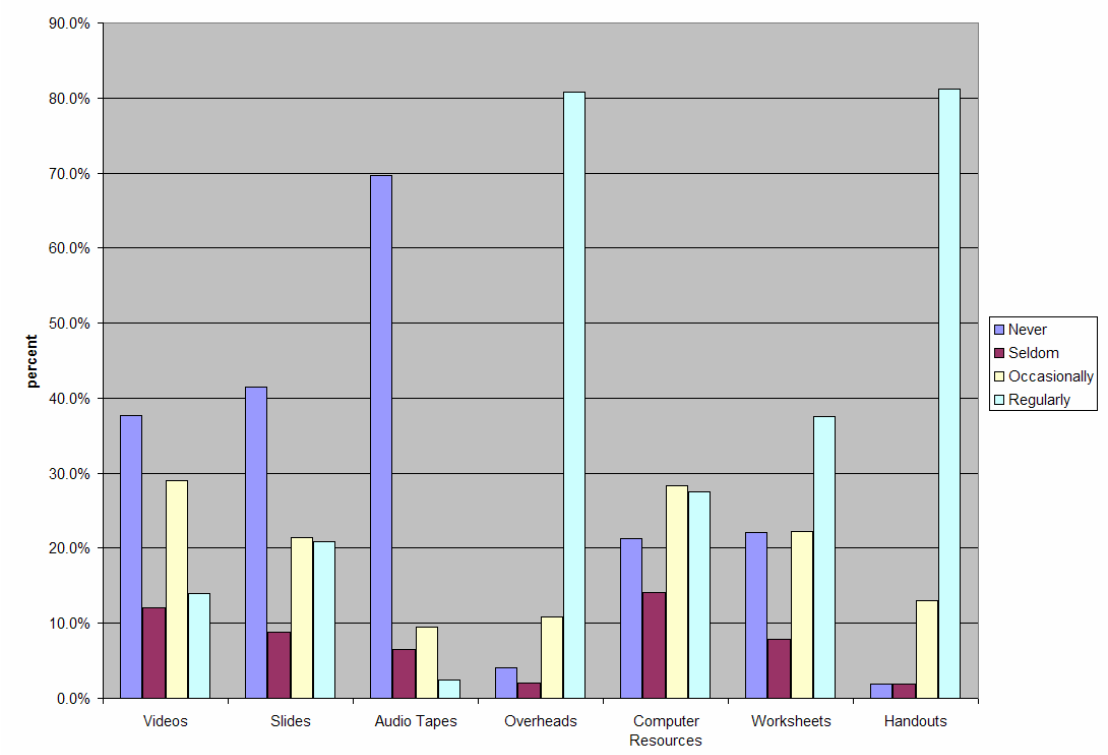
In this sub section the data is analysed to indicate changes in approaches to teaching through a breakdown of the use of different media in teaching.

### 8.4.1 Use of different media for teaching

The survey asked those with teaching responsibilities about their use of a range of different teaching media: video, slides, audio, OHPs, computers, worksheets and

handouts. The chart below (Table 6) shows a breakdown of the levels of use during 2000.

**Table 6. Use of Media for Teaching (2000)**



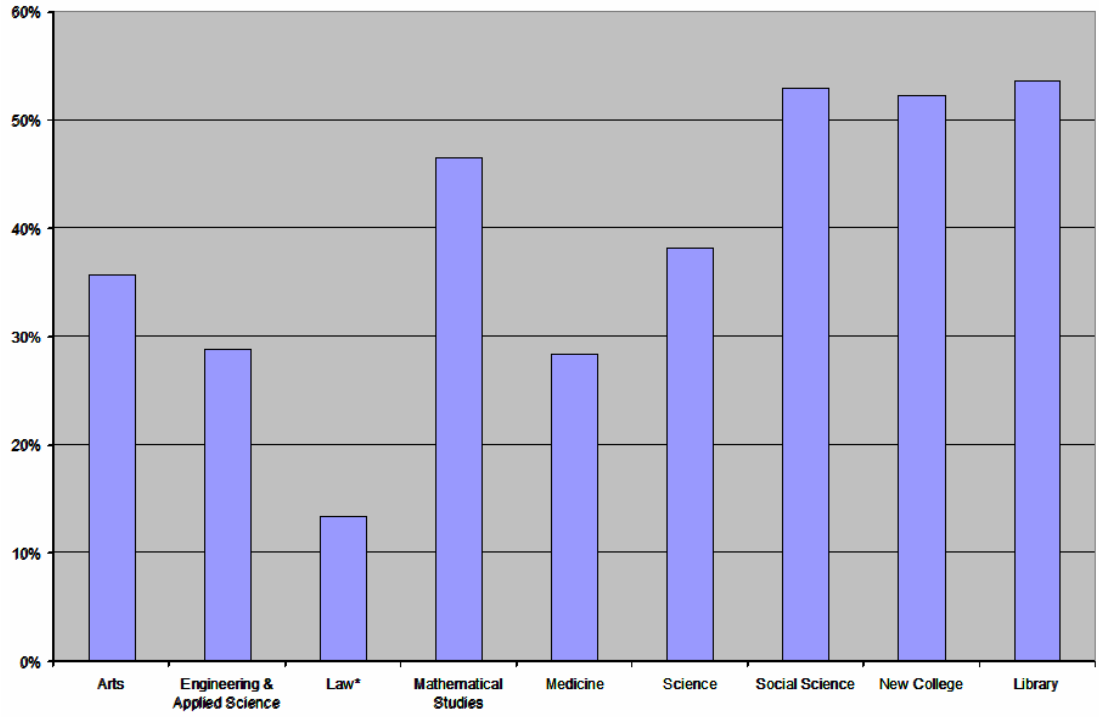

OHPs and handouts proved most popular, with just over 90% of respondents using them occasionally or regularly. Around 50% of all respondents said they had used computer resources regularly or occasionally in teaching over the previous year. This is a growth from the previous surveys where this figure stood at around 30%. There were some differences by faculty on the use of the different media, with Arts being the main users of audio materials, slides and videos.

## 8.4.2 Computer Resources in Teaching

Use of computer resources in teaching (Table 7) was generally between 30-50% and, on a faculty-by-faculty basis the distribution is broadly similar to that shown in previous surveys. The library, social sciences and mathematics are areas where

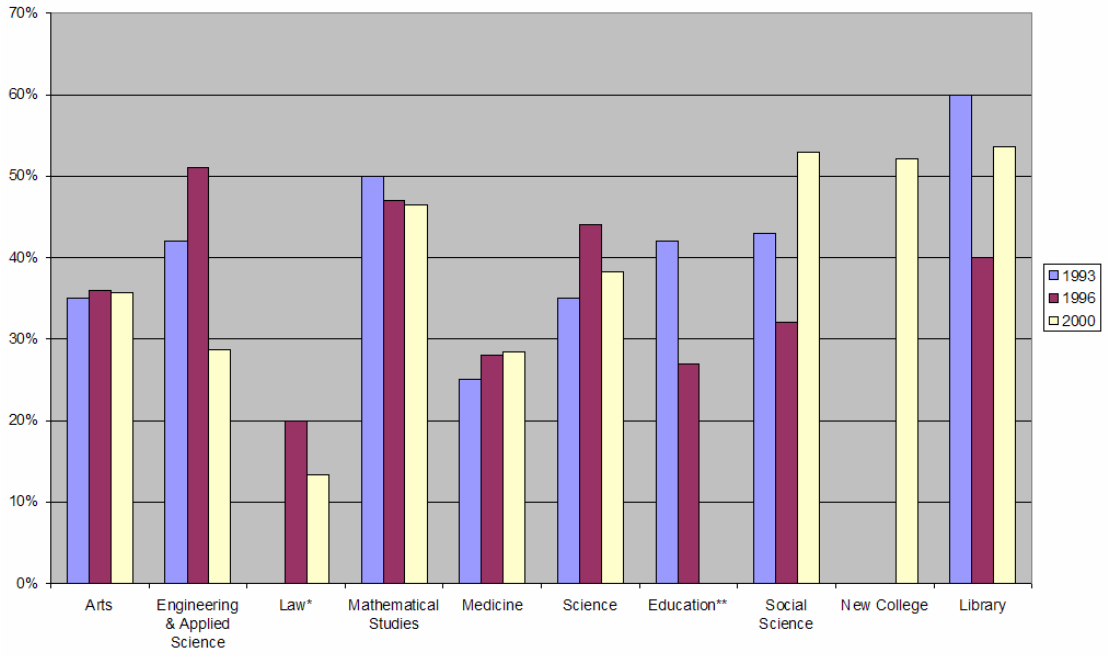
computer based resources are most made use of. Law consistently makes the least use of computer based resources.

**Table 7. Computer Based Resources by Faculty (2000)**




One area in which there appeared to be a relative change in the level of use was engineering. The chart shown below (Table 8) indicates the amount of usage of computer-based resources over time. There were no reports of use of computer-based resources in Law in 1993. New College is only featured in the 2000 survey. Education became part of the Social Science Faculty in 1999 which may account for some growth in that faculty's usage of these resources, although this change may also be directly associated with a Teaching and Learning Development grant project designed specifically to develop the faculty's intranet which had widespread support across the faculty.

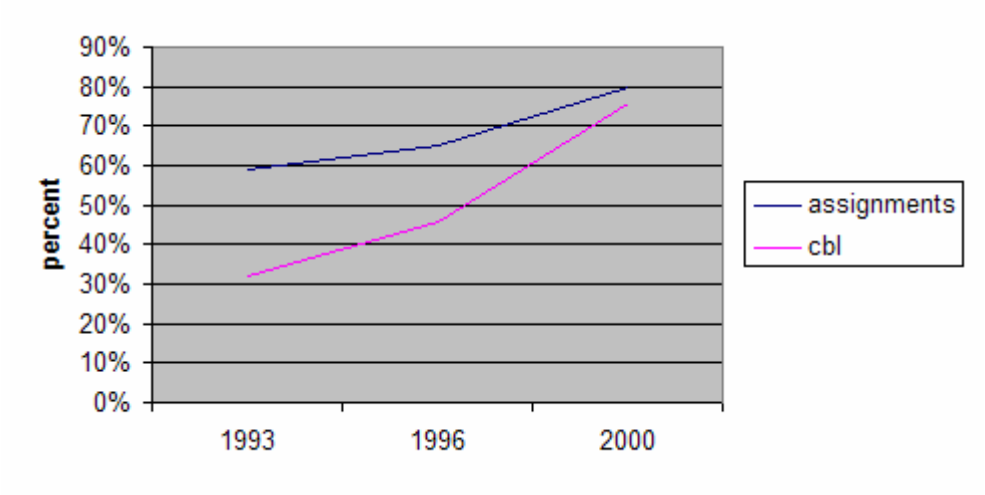
**Table 8. Computer Based Resources by Faculty over time (1993-2000)**




## 8.4.3 How students are expected to use computers

The two questions, asked about student use of computers for learning differentiated between use in preparing assignments and for access to teaching resources (Table 9). Some 80% of respondents reported that students were expected to use computers for preparing assignments. This figure showed a steady increase from 59% in 1993 and 65% in 1996. A second question asked whether students were expected to access course materials via computer (CBL on the chart). Here 76% gave a positive response to this question in 2000, again this had increased from 32% in 1993 and 46 % in 1996.

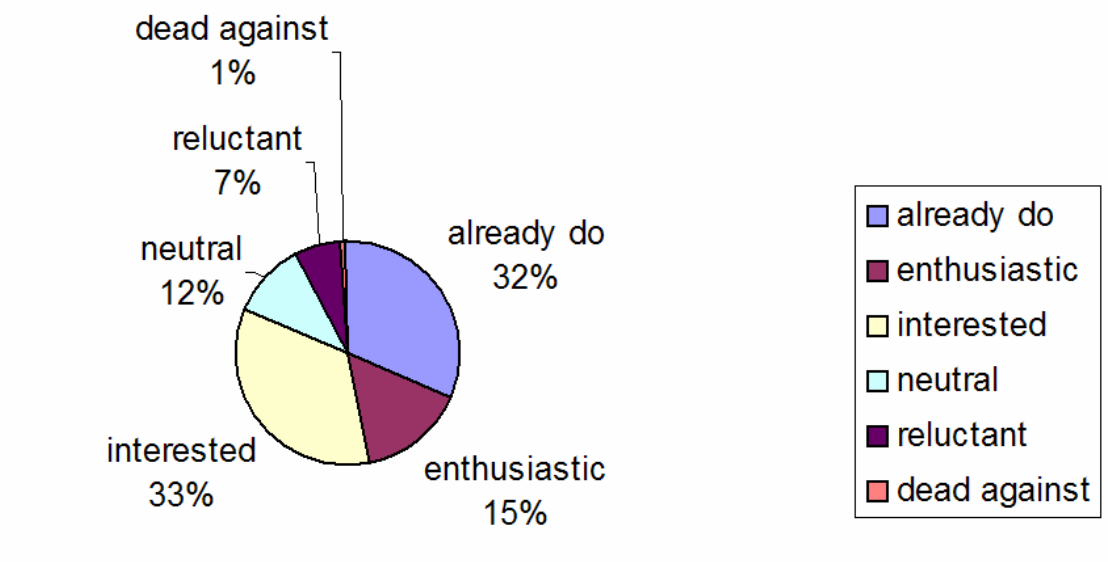
**Table 9. Student use of Computers over Time (1993-2000)**




## 8.4.3 Staff enthusiasm for using computers in teaching

The final questions in the survey looked at the degree to which members of staff were prepared to consider using computers in teaching and adapt materials to a computer-based format. This set of questions was not answered by all respondents, but the 63% who did reply, indicated that they would be involved in teaching in the future (Table 10).

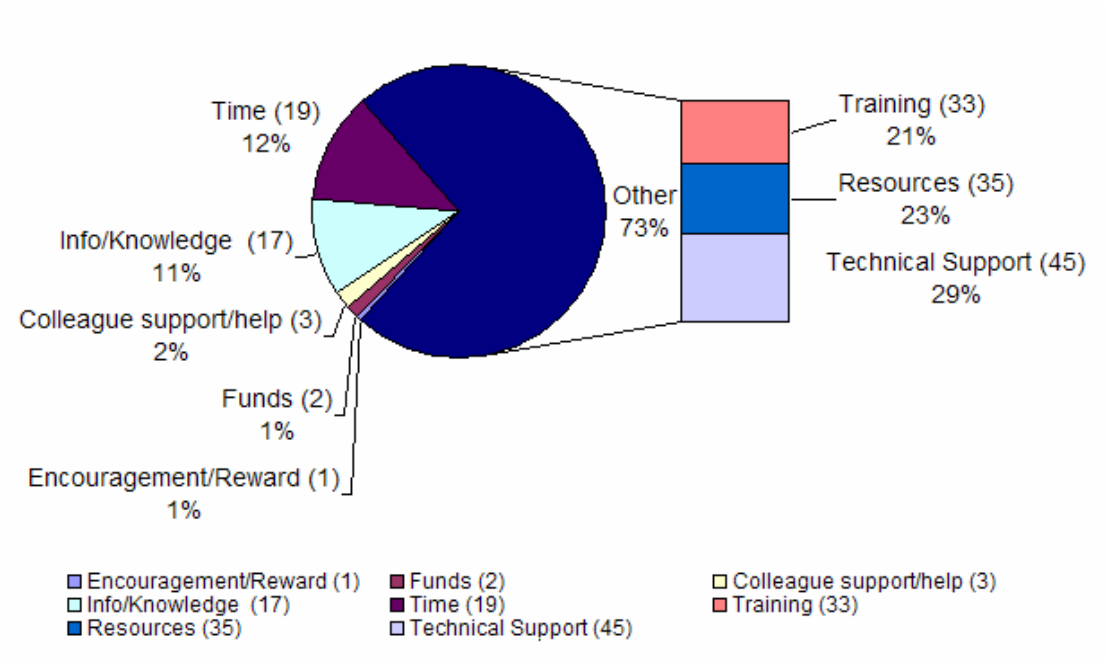
**Table 10. Willingness to Adapt Material to Computer Based Format**



Respondents who were already active were asked to give illustrations of their existing activity. The most commonly given responses indicated that they were using web pages, computer based presentations and preparing word processed notes. A few had been involved in the production of commercial software, or national initiatives such as TLTP. Some made use of discussion boards, quizzes and assessments, specialised subject specific courseware, or information servers and specialised simulation packages relevant to their discipline.

Both those who were already using computer based materials and those who were enthusiastic, interested or neutral at the prospect of moving over to such methods, were asked to indicate their views on what type of support would be required to help them achieve this change. Those already using computer based materials requested resources such as equipment in departments, staff to do development work and equipment in lecture rooms. Time was also identified as a significant factor along with information or knowledge about what could be done, how to do it and benefits which come from such change (Table 11).

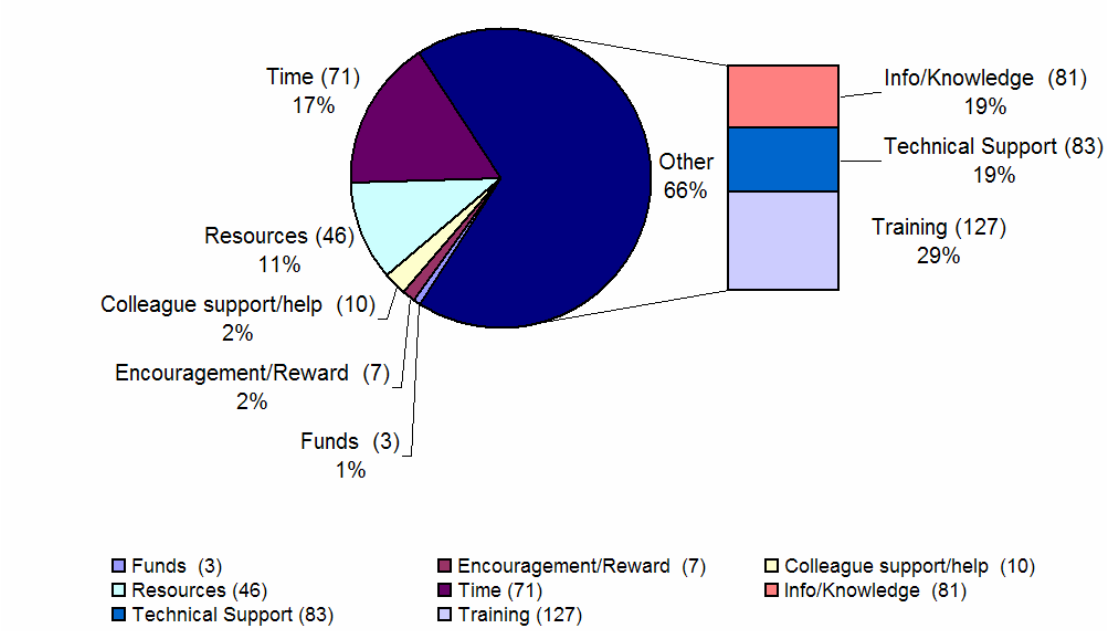
**Table 11. Help Required to Develop Resources by those who already use Computers in Teaching**



Other minor factors included support and help from colleagues, encouragement, recognition and reward and availability of funds rather than equipment or staff resources.

Among members of staff who were enthusiastic, interested, or neutral on adapting existing materials into computer based format, a large number of replies pointed to the need for additional training and technical support (Table 12). They also identified the need for information or knowledge about what could be done, how to do it and benefits which come from such change. The need for time and resources for development were also identified. Less important were funds, encouragement and help from colleagues.

**Table 12. Help Required to Develop Resources by Enthusiastic, Interested or Neutral Respondents**

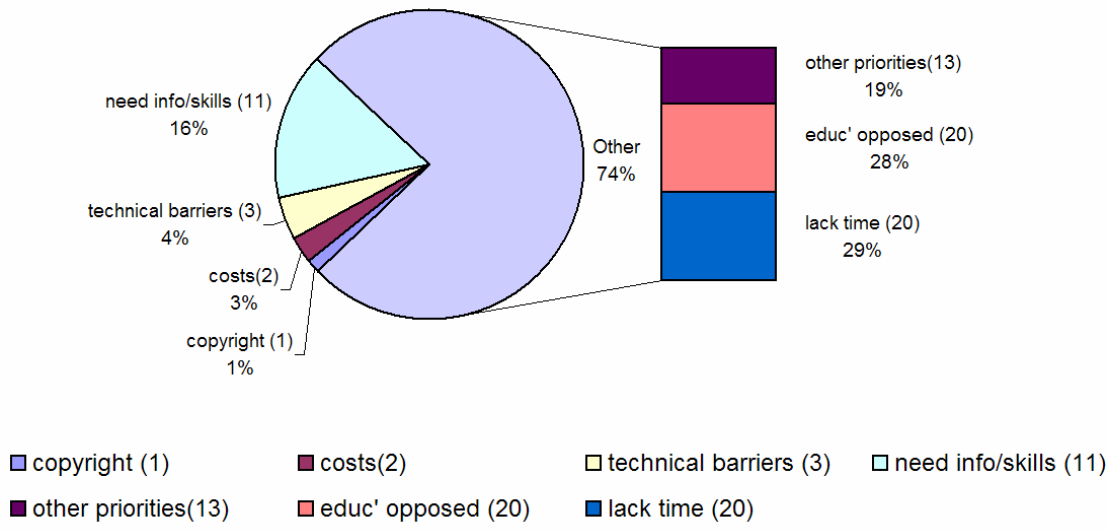



Among those who were reluctant or dead against, the most overwhelming reason given for opposition was the lack of time or knowledge and the associated costs of developing or producing computer based resources. A few indicated that they did not consider computer-based methods appropriate for the teaching objectives they wished to achieve.

## 8.5.9 Perceived barriers and grounds for opposition

The final group to be examined were those who were opposed or dead against the use of computers for teaching. From the summary chart shown below (Table 13) it can be seen that there was a strong sense of positive opposition: “would prefer to improve my computer experience in research first”, “contractual relationship is for hours teaching in traditional manner. Changes would have to be in own, unpaid, time.” “Time! Why reinvent the wheel when I have perfectly adequate material already”; “If material can be sensibly delivered via an electronic medium, let’s fire the teaching staff” .

**Table 13. Barriers Identified by respondents Dead Against Technology in Teaching**




Some gave the nature of their discipline as the reason for opposition: “Law is not appropriate for this type of remote access student learning” and “use of computers to teach theoretical physics is dangerous as students may think they don’t have to learn how to solve problems, but just how to use computer packages to solve them”. Others did not see a change in teaching methods appropriate: “remain unconvinced that it is appropriate and will assist understanding at part III and IV level”; “Dubious about the value added”.

Many cited lack of time or other priorities “Lack of interest. Lack of time.“; “Lack of knowledge & experience with the technology“; “Lack of knowledge and time“; “Lack of time“; “Lack of time to learn new skills. Other deadlines get in the way”.

It was not clear whether references to time and conflicting priorities were a consequence of the lack of reward and recognition which was only explicitly mentioned once.

Finally, only two people indicated that there were serious technological barriers changing their approach: “Don't understand it and how to do it”; “Do not have access to own computer - would be difficult to find time on shared machine to prepare work. Also shared computer not on university net”.

### 8.5.10 Reflections

Apart from the proportion of staff surveyed who do not have any responsibilities related to teaching or the support of learning (37%), there was no clear indication from the survey as to the relative teaching loads of the members of staff who responded. Members of staff who have to administer a number of classes with more than say 50 students may see a far greater benefit from using technology in their teaching than those with a lighter load with fewer students. Some ad-hoc exploration two years after the date of the survey, suggested that members of staff from areas with heavy loads who responded in the first instance were frequently users of the Blackboard learning environment.  It may, therefore, be useful in further study to pursue this line of enquiry.

Similarly the nature of software used in teaching can reasonably be expected to relate to the balance of disciplines and the tradition in study method which is prevalent in the institution. It might not be realistic to expect to see large use of discussion boards in subject areas which have heavy components of lab, studio or workshop activity. Barriers and drivers to change might therefore vary across subject disciplines in relation to the typical size of classes and prevalent methods of study. These issues might benefit from further study.

From the comments and analysis cited in this chapter it would seem that there is a good fit between the responses from the academics and the suggested response to barriers and drivers to the use of technology which Geoghegan identified .

There is a further question as to whether the organisational structure of the university in itself effectively skews the distribution of the academics with respect to their propensity to adopt and integrate new technologies into their teaching.

Furthermore it may be that the working practices associated with a research led and collegial institution, like the University of Southampton, in themselves serve to amplify the perceived barriers to change. If that is the case then it may be that the organisation model of an institution can in itself be identified as a factor in determining the ease with which it is possible to introduce and drive change.

## 8.6 Conclusions

This chapter has provided an account of a series of surveys of staff attitudes towards the use of learning technology at the University of Southampton. Analysis of the data collected has drawn attention to some of the perceived barriers and drivers which can affect the uptake and successful use of computers in learning and teaching. This analysis also suggests that organisational factors may amplify or dampen the effect of known barriers and drivers thereby influencing the effectiveness of the uptake and use of technologies in teaching and the support of learning. This hypothesis should form the basis of further research to establish whether it can be substantiated across a wider range of institutional types and contexts.

# Chapter 9 Institutional Analysis

**This chapter provides a detailed overview of the approach adopted in the analysis of the institutional and interview data collected during the second part of this study.**

**Semi-structured Interviews were conducted with respondents from six universities who had been selected using a chain sampling technique. Responses were recorded and the data was transcribed and then analysed with the assistance of NVivo software. Parallel analysis was undertaken of existing data in the public domain. These sources are, for example, institutional strategy documents and numerical information published by organisations such as the UK Higher Education Statistical Agency (HESA).**

**The chapter provides an account the analytical process and initial analysis. It concludes with an observation through the initial analysis of the emerging data identifying a number of factors which appear to be important in acting as drivers or barriers to bringing about organisational change.**

## 9.1 Introduction

Chapter Eight, 'Attitudes: The Academic Perspective' provided an account of the collection and analysis of detailed quantitative data on staff attitudes and beliefs at the University of Southampton. It also offered some analysis of associated qualitative data. It was subsequently decided to augment that initial study by collecting in-depth qualitative data on institutional experiences across a range of UK Higher Education institutions.

The objective was to identify how individuals and their institutions experienced the "drivers and barriers to change" in the specific context of the introduction, use and uptake of learning technologies in their individual institutions. The objective was not to perform a micro analysis of the factors which promote or inhibit change. Instead it was intended that the analysis would assist in identifying factors which impacted various levels within the institution, and whether some factors were more commonly acknowledged than others. Thus, by analysing this data it was intended that the model of uptake factors discussed in earlier chapters could be elaborated and tested.

## 9.2 Institutional Study Details

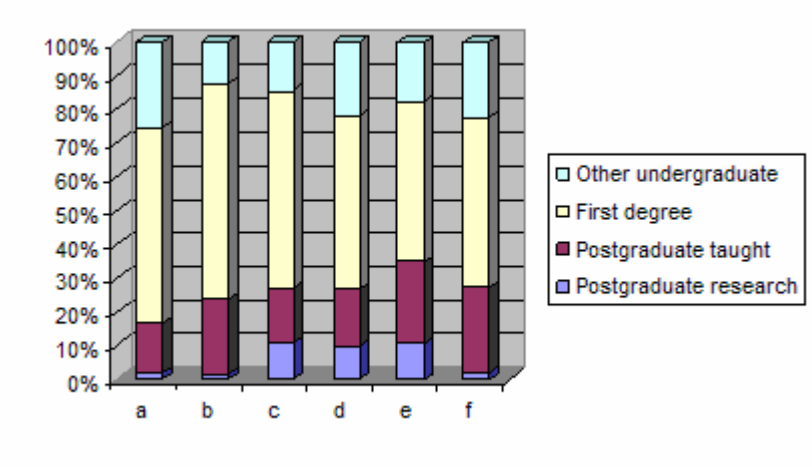
Some aspects of the methodology have already been discussed in detail in Chapter Two, 'Research Methods'. Institutional study interviews were conducted at six different UK Higher Education institutions. In terms of broad size and total teaching numbers they were similar to the University of Southampton. They represented a range of institutional types; from those for whom the majority of income was derived from teaching ('teaching intensive') through to those where the majority of income was derived from research and consultancy ('research intensive'). A comparison in terms of size with respect to student numbers is detailed below (Table 14).Data is drawn from HESA for the academic year 2002/03.

**Table 14. Table of institutional profiles source HESA academic year 2002/03**

| institution | a | b | c | d | e | f |
|---|---|---|---|---|---|---|
| full-time | 16915 | 17880 | 20310 | 15940 | 13190 | 12885 |
| part-time | 10105 | 8600 | 5195 | 6380 | 8990 | 7310 |
| Postgraduate research | 465 | 385 | 2730 | 2205 | 2420 | 435 |
| Postgraduate taught | 4060 | 5905 | 4125 | 3765 | 5295 | 5090 |
| First degree | 15610 | 16855 | 14965 | 11460 | 10590 | 10175 |
| Other undergraduate | 6885 | 3335 | 3685 | 4885 | 3885 | 4500 |
| **Total** | **27020** | **26480** | **25505** | **22315** | **22190** | **20195** |

However the research intensive institutions had a significantly larger number of post graduate research students (Table 15). As such they can be seen to fall across the spectrum of institutional types which McNay identified (McNay, 1995).

**Table 15. graphical representation of teaching commitment across case study institutions**




Their exact place on this categorisation and the implications of this categorisation is discussed later. Although the number of institutions examined was small, the data generated was large, and detailed analysis time consuming. The small sample is a necessary limitation of the in-depth qualitative approach to interviewing across the institution. However the high volume of information gained by such an approach is valuable in providing insights into and understandings of the systems of change as they are experienced in UK Higher Education institutions.

Interviewees were identified by a chain sampling method (Miles and Huberman, 1994, Millen, 2000). Individuals who had acknowledged expertise in learning technologies were used as the starting points for the sample chains at each institution. Initial contact was with an identified local expert who had particular responsibilities associated with the use of learning technologies. since there was a wide variety of organisational structures across the institutions which were studied ,this title and location of this role necessarily varied from institution to institution. However all initial interviewees held senior positions in their respective institutions. They ranged from a contact employed in one of the professional who had expertise and responsibilities in the use of learning technologies, through to individuals with senior academic or managerial roles and responsibilities.

Follow up contacts were recommended or selected based on local knowledge and understanding. Successive interviewees in the chain where approached with the objective exploring issues identified in the initial interview and thereby gaining a wider

understanding of the experience of introducing and supporting learning technologies across the institution. In some cases additional subjects were identified during the course of a subsequent interview. The sampling method was designed to ensure that the information gathered reflected a range of experiences in each institution.

The exact role and title of individuals who were interviewed varied; however, typical roles and responsibilities are listed below:

- Deputy Vice Chancellor/Pro Vice-Chancellor with responsibility for learning and teaching
- Head of Information Service/Computing Service/Library
- Chair(s) of relevant committees or working groups
- Head(s) of university initiatives concerned with supporting or promoting learning technologies (May also include staff development)
- Local experts/champions in the areas of Learning Technologies or Higher Education

Local experts and champions included Individuals in managerial roles, key workers in support services and individual academics; all with specific expertise and responsibilities in relation to learning technologies. The way in which the relationship between these roles and their areas of expertise was understood to exist before the interview process took place is shown below (Figure 23).

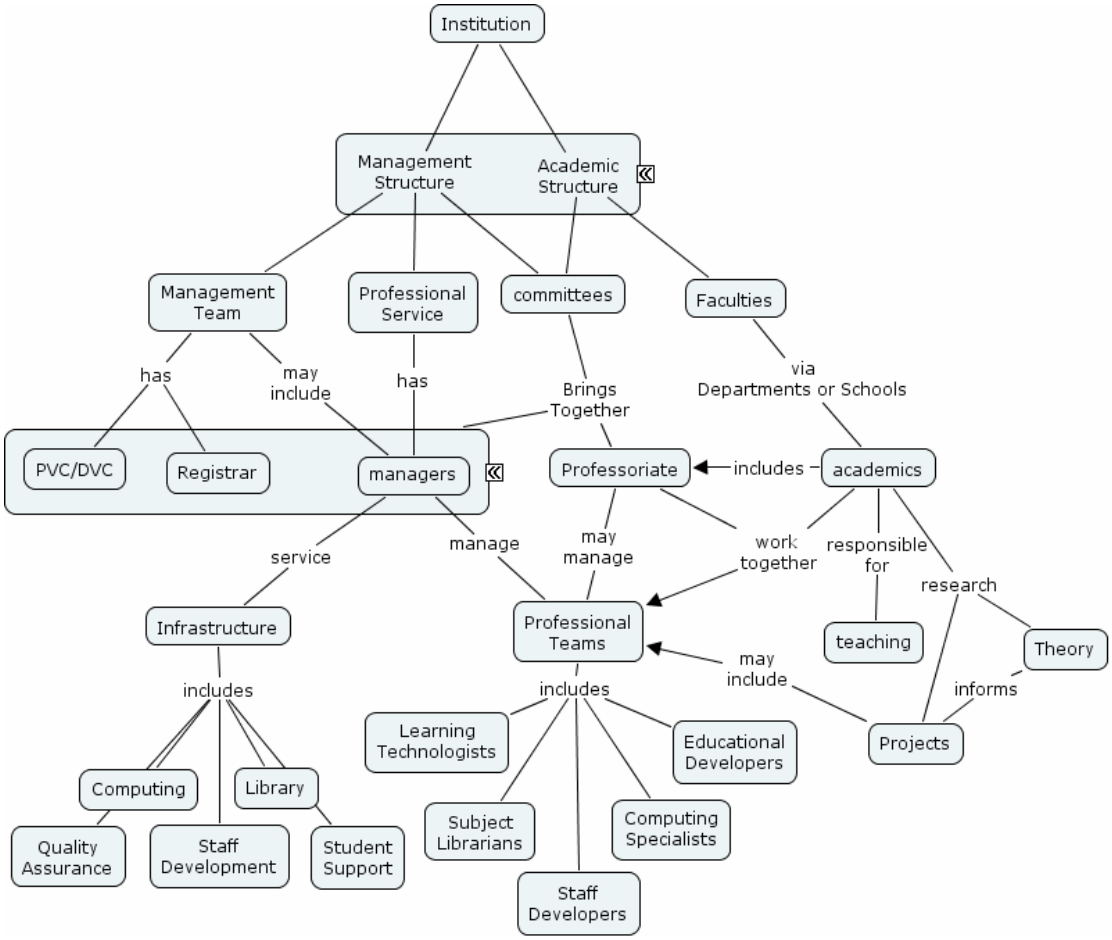



**Figure 23. Learning Technology Expertise Inter-relationships**

There were normally at least six interviews per institution. In most cases interviews were held with single individuals, although in some cases institutions chose to present a small group of individuals who considered and responded to questions in a small discussion format. Typical interviews lasted between 30 and 45 minutes.

Participants were offered a transcript of the interview (although no-one took up this offer), and were assured that all data would be made anonymous in the write up and analysis. Subjects were also offered individual copies of the final thesis and the opportunity of a follow up discussion in the institution to explore the points which emerged from the whole study.

Subjects were asked a series of semi-structured questions designed to help gain an understanding of the organisational structure within each institution and to explore

the history and experience of the uptake and use of learning technologies in that institution.

Academics, managers and support staff who were interviewed overwhelmingly appeared to be comfortable with the process, responding openly and being helpful and forthcoming. In the case of a few academic staff, there appeared to be some equivocation in their responses, perhaps due to either to personal style or a desire not to colour the outcomes of research. Information gathered from the interviews is being augmented by the use of previously published data from the public domain.

## 9.3 Interview Process and Structure

The semi structured-questions were derived from the basis of Damanpour's meta-analysis of the key components of the Structure of Innovation (Damanpour, 1991). The approach has been discussed in greater detail earlier in Chapter 2 'Research Methods'. Questions were designed to probe the relationship between organisational structure and the uptake and use of learning technologies. They are outlined in the next section and summarised below (Figure 24).

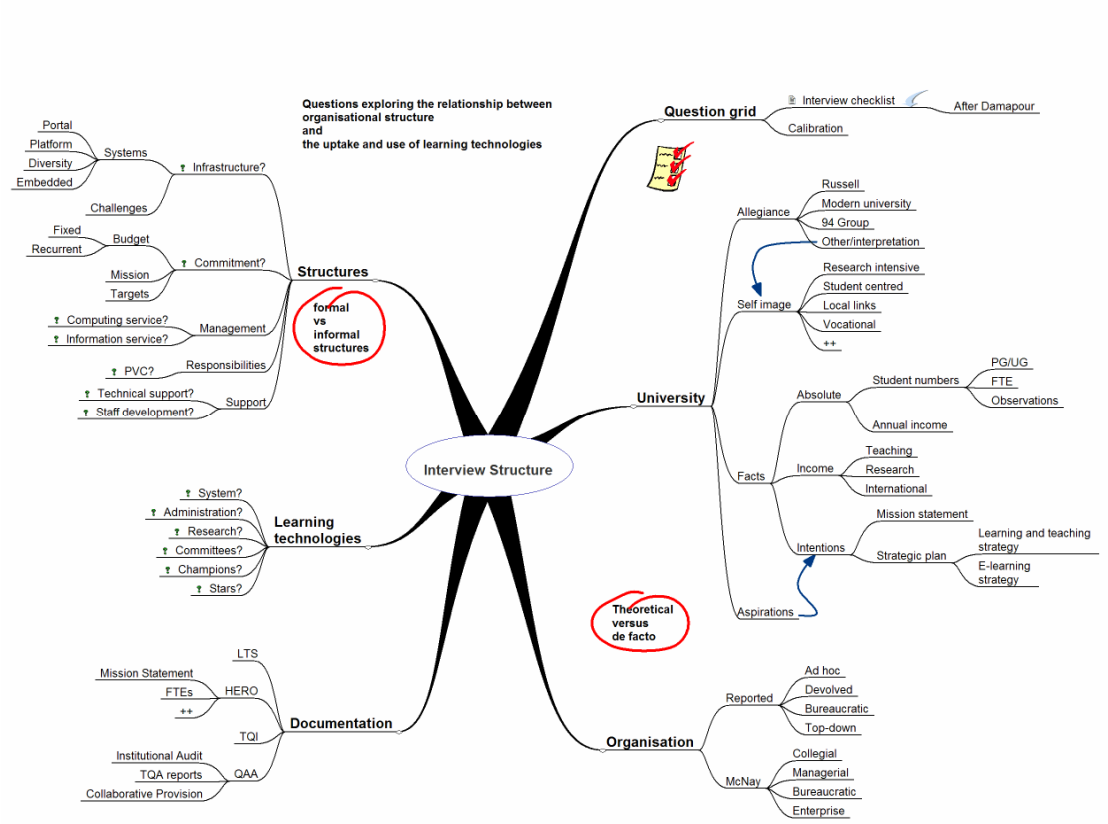



**Figure 24. Mindmap Showing Interview Structure**

## 9.4 Analytical Method

As is often the case with qualitative research, some data collection took place concurrently with the analysis. Analysis of the data began with ‘open coding’. Transcripts from the interviews were reviewed alongside notes which had been made immediately after the interviews. The transcripts were read and distinct components identified. Information was coded which identified aspects of organisation, structure, culture and climate (see also Chapter 1 – Introduction and Chapter 2 ‘Research Methods’). The objective was to capture participants’ perceptions of their current experience of change both in their past experiences of change. Coded information points were identified through accounts of individual experiences; for example experiences of events, actions and institutional policy. The diagram below shows the initial concepts which emerged from the first pass of open coding.

A few broad categories are associated with the data, but the objective at this stage with the data is to reflect emerging concepts rather than to apply any specific analysis. As tentative linking concepts were introduced it became clear that there was ambiguity in the nature of the coding, and that clarification of ideas was needed to be able to articulate the meaning which was being placed on the concepts. Following this initial coding process, the emergent concepts were reviewed and grouped into more structured themes. Below (Figure 25) shows the concepts reviewed (and in some cases renamed) clustered and grouped into related theme areas.

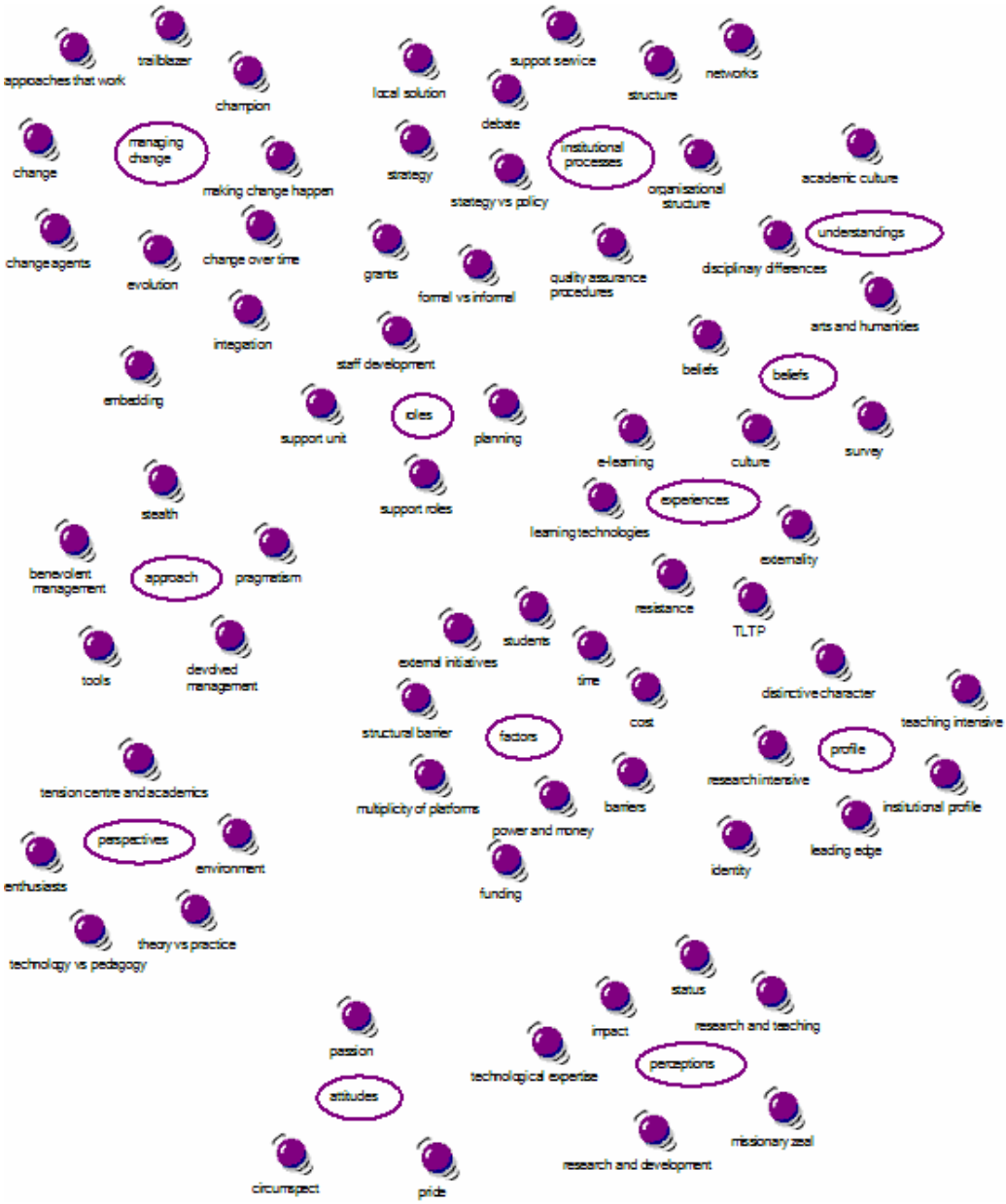



**Figure 25. Open Coding ideas clustered into initial themes**

Concepts were analysed and compared across respondents and also against existing theoretical perspectives (see also Chapter 7, ‘Change, and Innovation’). This approach has been applied to each account so that what ‘emerges’ from this analysis and is presented in this chapter, is an aggregation of the entire set of accounts, rather than a particular individual account.

NVivo software was used to support this analysis. The software provides a set of annotation tools specifically designed for qualitative analysis. Data is held in an environment where it can be searched, indexed, linked, cross referenced and analysed.

As well as interview transcripts it was possible to include analytical notes and formal documents within the NVivo environment; for example policy and strategy documents. Using software of this type is particularly valuable when dealing with large volumes of data since it helps keep track of the coding and supports the systematic analysis of the coding decisions.

## 9.5 Analytical Perspectives

Initial analysis was derived through the examination of a combination of post interview notes, where analysis reflected the researcher's perspective and pre-existing theoretical approach, and preliminary open coding undertaken in NVivo which reflected the interviewees' perspectives in response to the semi-structured interviews. The key analytical perspectives which initially emerged through this analysis are shown below (Figure 26).

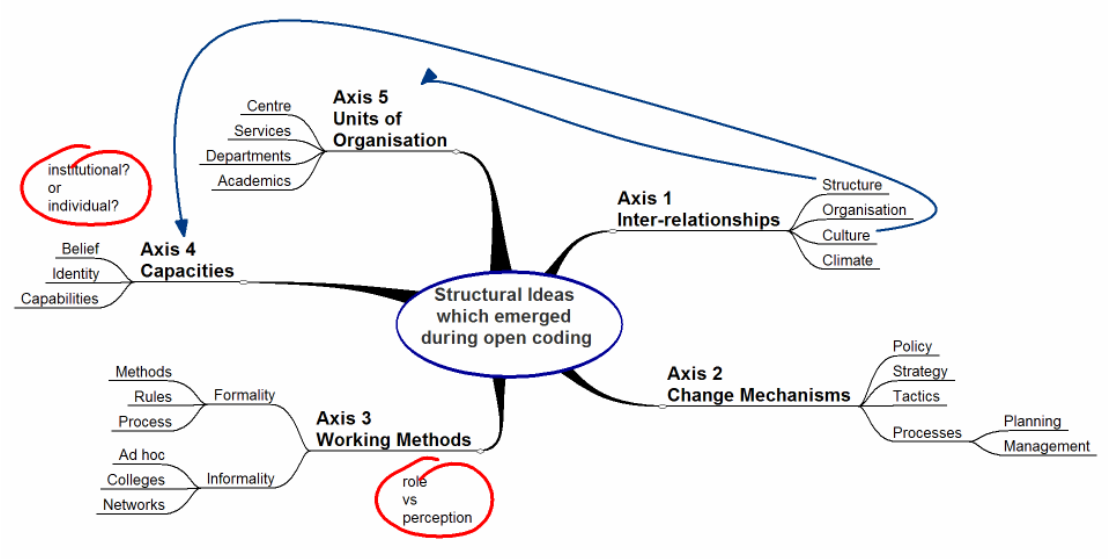



**Figure 26. Mindmap Showing Structural Ideas which emerged during Open Coding**

The early structure suggested that it would be worthwhile to analyse the data along five broad areas, which will be discussed in the next chapter:

1. Inter-relationships
2. Change Mechanisms
3. Working Methods
4. Capacities
5. Organisational Units

## 9.6 Conclusions

This chapter has looked in detail at the research methods adopted during the Institutional Studies. The process of the interviews generated very large volumes of data. After transcription the interview texts were entered into a database. The interview content was reviewed and concepts identified by the subjects were marked up. The marked up concepts were then pooled, graphed, considered and clustered. As a consequence of this process a number of key concepts emerged which will be discussed in greater detail in the next chapter.

# Chapter 10 Experience: The Institutional Perspective

**This chapter provides a detailed account and analysis of the interview data collected during the second part of this study. Interviews were conducted using semi structured questions. Responses were recorded and the data was transcribed and then analysed with the assistance of NVivo software. This information was augmented by existing data analysis found in published documents and available in the public domain. These sources are, for example, institutional strategy documents and numerical information published by organisations such as the UK Higher Education Statistical Agency (HESA).**

**The focus of the chapter includes a consideration of the difference between systematic approaches and systemic approaches to change. Systematic approaches to change are typically managed in a top-down manner whilst systemic approaches to change are developed by those supporting existing practice and incorporating the use of new methods and introducing change in this instance as practitioners engaged in teaching and the support of learning.**

## 10.1 Introduction

In the process of transcribing and marking up the data to identify emerging concepts, five distinct areas of focus were identified.

6. Inter-relationships
7. Change Mechanisms
8. Working Methods
9. Capacities
10. Organisational Units

The remainder of this chapter presents and analyses data from the interviews from the perspective of each of the five focus items.

## 10.2 Inter-relationships: Structure, Organisation, Culture, Climate

### 10.2.1 Structure and Organisation - Managers and Non Managers

The analysis in this section has been derived working from the model of organisation structure culture and climate originally outlined and explored in Chapter 2. For ease of following this argument, the diagram is included again (Figure 1).

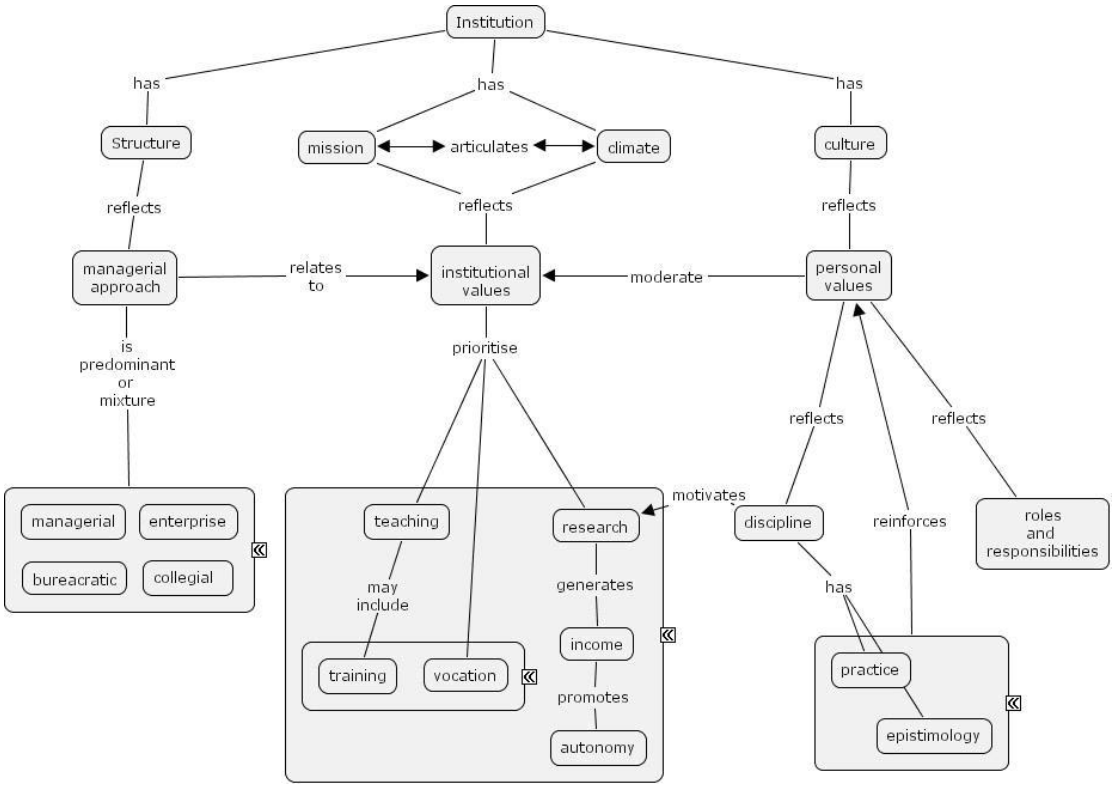



**Figure 27. Concept Map Exploring the Relationship between Organisation Structure Culture and Climate**

In categorising views below interviewees have been clustered into two broad structural groups: managers (members of the executive and heads of professional services) and non managers (academics, support staff and teachers).

The nature or organisational relationships were reasonably consistent between institutions, although in specific instances formal titles and details of responsibilities did differ a little. Some aspects of these differences are highlighted in the further analysis of individual perceptions detailed below; Broadly, the organisational roles and responsibilities correspond to the diagram shown below (Figure 2).

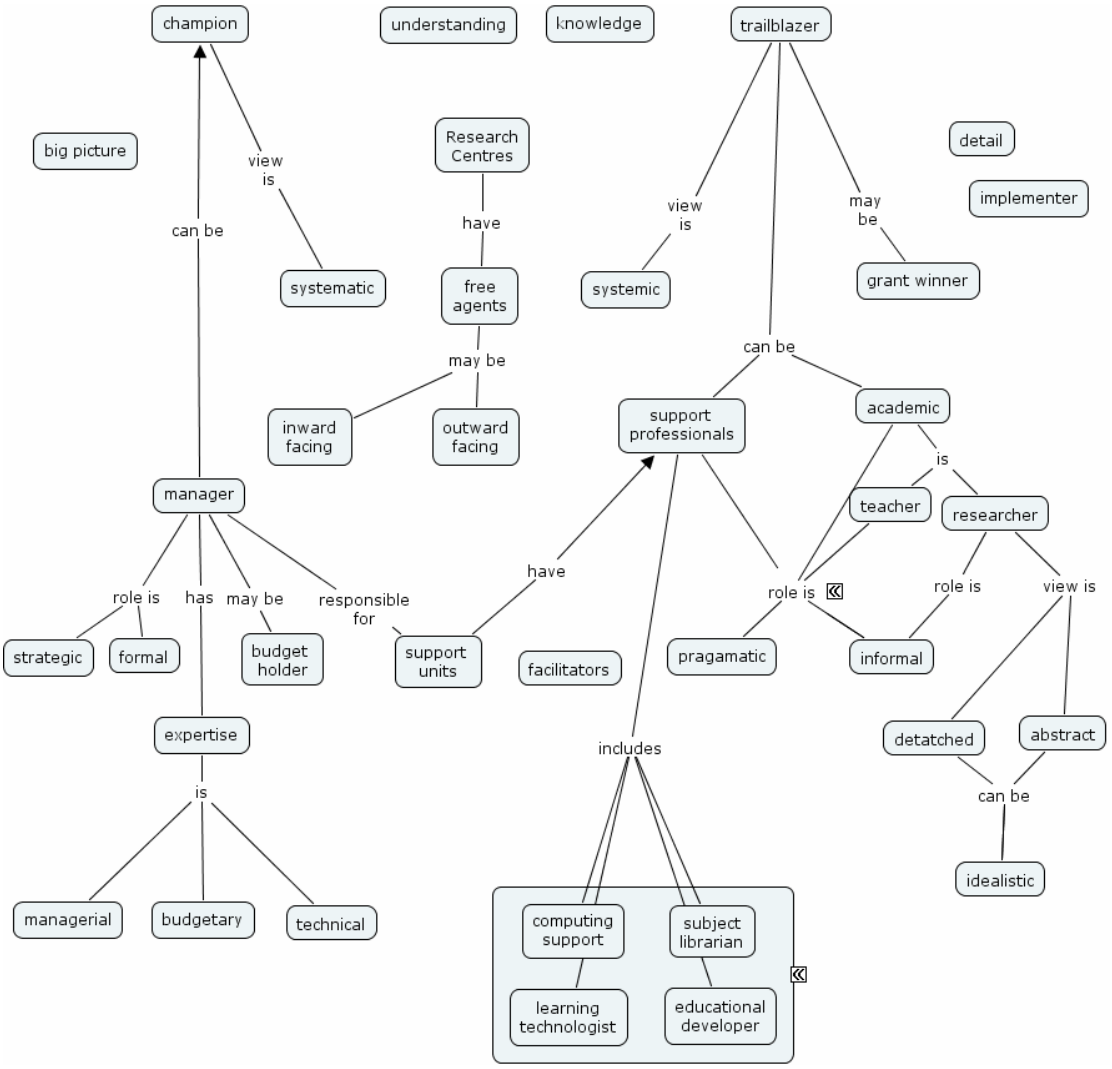



**Figure 28. Concept Map of Roles and Responsibilities Showing Power and Influence**

The diagram, although very similar to the pre-interview structure chart, differs in that it reflects some of the understanding of the dynamics of change and decision making related to learning technologies which emerged following the process of the

interviews. Interviewees' institutions represented two broad types of **institutional culture**: research intensive and teaching intensive. Although previous models examined have been more complex, at this stage of dealing with the qualitative data this cleavage best reflects the differences highlighted by the interviewees. In addition it is the best grouping given the small number of total case studies.

In the teaching intensive institutions there was a strong acknowledgement of the importance of local links. Statements found in the institutional mission were reiterated in responses from interviewees, and reflected a strong financial driver in institutional behaviour. In all cases local recruitment was an important objective; local teaching via outreach or collaborative links was important. Local populations and employment were perceived as affecting the buoyancy of student numbers. Thus the locale could impact on the nature of teaching activities, might stimulate the use of learning technologies, and had a direct impact on finances through funding associated with student numbers.

Teaching institutions were typically presented as *"poor but solvent"* and there was an emphasis on *"having an eye to the bottom line"*. Financial and organisational management **structure** included strong centralised management and a devolved approach, although most often management from the centre exerted a stronger pull.

Structure in the research intensive institutions differed;. there was greater financial autonomy both for the faculties, departments and schools, and for the individual academics. Higher proportions of research grant and consultancy supported self direction as well as financial autonomy.

In teaching institutions there was an aspiration expressed by managers, academics and support staff to attain greater research and consultancy funding because of financial autonomy which would be associated with such funding.

A sense of the culture and climate of the institution was inferred by examining the understandings and experiences of managers and non-managers across the institutions. It was observed that those institutions which had achieved the greatest extent of the use of learning technologies reflected a more consistent understanding of the objectives and benefits of using technology in their particular institutional

context. This was true irrespective of whether the institution was research intensive or teaching intensive.

Managers in the teaching intensive institutions expressed pragmatic views and frequently demonstrated pragmatic approaches which had been adopted both in their personal interventions and in the broader development of an institution-wide approach to learning technologies, and to the pursuit of external funding. There was a strong consistency in approach and rationale of managers in teaching intensive institutions whether they came from an executive or an operational perspective.

Development in research intensive institutions was more likely to be described by the managers as "*laissez faire*". Managers who came from the professional services demonstrated high levels of professional skills. They typically had broad-ranging experience, often having worked in a number of related roles, sometimes across a number of institutions, most often also within research intensive environments. Professional managers' accounts of their activities and managerial perspectives frequently reflected personal pride in the approaches they adopted, and referred to applying "professional values". Their language also frequently reflected the operational considerations of the roles and functions which they fulfilled. In this respect their accounts were similar to the range of managers in teaching intensive institutions. Managers in research intensive institutions with executive responsibilities were more likely to refer back to their disciplinary allegiances and experiences and to present their understanding of the issues in the context of the institutional mission associated with their particular role. They were more likely to refer to institutional values and articulate institutional pride in their achievements.

Pride in achievements and a clear articulation of personal values was also present in the responses of those interviewees drawn from non-managerial roles. There was consistency in the responses across the broad institution types although there was a stronger theoretical bias in the accounts and responses of academics drawn from research intensive institutions. Accounts of achievements and objectives were typically framed either in the context of teaching priorities from a discipline perspective, or from the technical or educational perspectives of a support role. The statements reflecting pride in personal or institutional achievements along with the

reflection of personal and institutional values were used to judge the climate within particular institutions[1]

## 10.3 Mechanisms: Strategy, Policy, Processes and Tactics,

A variety of mechanisms were observed which can bring about change. At the top level, strategy sets objectives and articulates institutional ambition. Policy provides guidance and a framework within which strategy can be realised. . Processes may be routines which support strategy but are not articulated in the same clear manner as policies. At a more practical and pragmatic level, individuals devise and utilise tactics which can bring about or support change.

### 10.3.1 Strategy

All institutions studied had learning and teaching strategies – some had solely a learning teaching and assessment strategy, some incorporated an e-learning strategy, others had a separate but associated e-learning strategy. Often the documents were available in the public domain, but where this was not the case, managers were happy to make a copy available for the purposes of this research.

In some instances in the teaching intensive institutions, the learning and teaching strategy had pre-dated the HEFCE Teaching Quality Enhancement initiative (HEFCE, 1999a, 1999b) which had required institutions to submit their learning and teaching strategy to the funding council and initiated the rounds of Teaching Quality Enhancement funding in 1999. All institutions had seen a number of iterations of their strategies and had used a system of working groups and committees, and consultative ratification of the teaching and learning strategy.

The valuable role of HEFCE and the JISC in motivating the development of these strategies was widely acknowledged. All institutional managers pointed to ways in which the institution had used funds in a variety of different ways to benefit the use of

[1] It was observed by one interviewee, who had extensive experience of reviewing institutional achievements with respect to e-learning, that claims of the extent of implementation varied. The self reported nature of this information and the motivation of institutions to show themselves in a good light makes objective comparison of achievements difficult.

learning technologies in their institution, and interviewees acknowledged the value of external drivers in enabling them to take forward the agendas which they had identified in the strategy.

Although institutions have been using central funding from HEFCE to direct aspects of the learning and teaching strategy or a specific e-learning strategy, some academics were more equivocal about the impact of the strategies.

> *"I don't know whether it impacts on Academics at an individual level. I wonder …. I have wondered in the past whether we have really had a strong focal point for strategic development for, let's say, e-learning broadly".*

Similarly although there was widespread reference by the managers to external strategy documents such as the HEFCE e-learning strategy (HEFCE, 2005a), these were not typically referenced by the non-managers.

### 10.3.2 Policies and Processes

Some institutions had also created explicit policies on learning and teaching, or e-learning, and in those instances managers emphasised the importance to their institution of the existence of such policies. Policies typically existed in institutions with a more managerial approach. Those institutions with a mixed approach to management often pointed to policies which were incorporated into documents such as the variously named Quality Manuals and the Tutors Handbooks. In these instances it was implicitly acknowledged that the existence of learning and teaching policies and the e-learning policies had also been influenced by the external driver of the Quality Assurance Agency (QAA).

Professional services can be seen as a structural device which can achieve goals consistent with the ambitions of the institution. Their potential to drive and direct change was not lost on the professional managers who were interviewed, for example:

> *"People work from a professional perspective to drive innovation because professionally this is part of the role and you are then changing the culture without having to go for structural change".*

It was acknowledged that managerial and strategic approaches vary across the sector.

> *"the trouble with you researchers is you make us think about what we are doing and why we are doing it"*

If some approaches may be more successful than others depending upon the situation and circumstances of the institution, then the value of self understanding becomes all the more important.

Managers interviewed showed an interest in the work of other institutions and the progress which was being made. One interviewee pointed to a conversation he had had with a Pro Vice Chancellor at another institution. Both had made use of TQEF funds to address some aspects on the e-learning agenda. The other institution had taken a strongly managerial approach, defined a timetable of objectives, targets and measured outputs. The interviewee's institution had taken a less formal approach, but had provided infrastructure and rewarded and recognised good practice.

> *"but when we compared progress we were just about at the same place forward"*

Some managers see policies and processes put into place as a means for furthering agendas.

> *"The TQEF was a great bonus for us over a number of years, we have used it for a number of agendas over a number of years… we have had supplementary money which we could use for a number of agendas…particularly around transition, assessment was a key issue…all these things were sort of drivers.. I think e-learning benefited from that"*

### 10.3.3 Tactics

In some institutions (both from teaching intensive and research intensive), Quality assurance processes were in effect used as device or tactic for achieving the objectives of the learning and teaching or e-learning strategy. When questioned managers were sensitive to the tensions between the needs of quality assurance processes and the objectives of quality enhancement initiatives. Managers and non-

managers spoke of initiatives designed to “improve the student experience” or seen as “how we make learning better”.

There was evidence of institutional tactics which were sensitive to predominant cultures:

> *“Our learning and teaching strategy has a goal which is to support and to develop innovative forms of learning and teaching. So to try and do this in this research led institution, we actually took some of the HEFCE money and we took some of the University money and we created a pot of funds”.*

Institutions also develop tactics which address predominant views. At one institution an academic remarked ruefully that as far as getting more widespread use of learning technologies was concerned *“staff development does not work”* A manager at another institution explained how they did not do formal staff development courses on e-learning. Their approach was to ensure that the procedures associated with establishing an e-learning teaching resource were conditional on processes which ensured that the staff involved received the appropriate development. The development activity was an embedded part of the process of setting up the e-learning activity. It was directed to a particular need at a particular time and did not take place as general e-learning staff development workshops.

Other managers explained how short term funding from central initiatives provided pump priming for support activities and

> *“if it works the faculties will find a way to pay for them”.*

Managers also referred to the general approach which they took, or which was adopted in their institution, describing it in pragmatic terms…

> *“I don't think in the broad learning and teaching area, the e-learning, we have been strongly managerially driven in what we have done. But I think we have, at the appropriate points in time, provided the sort of frameworks; so, there have been steps we have taken at certain points where, and its not after the event but its not to enable the event. We got to a point where we realise yes we’ve got to do that if we are now to be able to move it along and there is going to be more general take up, so its been benevolent management; So, to create frames wherein that systemic change can take place….There would be those*

*who feel we have not been managerial enough, I know some of my colleagues think we should have laid the rules down much more strongly and we should have had requirements and we should you know have targets and outputs and what have you."*

Taken together however the responses largely confirm that external initiatives have the potential to modify the actions of an institution.

However there may be limitations in the strength of this influence.

*"There is a worry in the sector that we don't get joined up thinking, we seem to see different agendas for example from the QAA, The Academy HEFCE, JISC".*

None the less, external pressures do have some impact although local factors are important addition which will mediate the extent of this modification as will be discussed further later in the chapter.

Tactics adopted by individual academics varied according to their motivations. They ranged from experiments designed to change teaching methods which could also lead to publishable research on the introduction of approaches designed to tackle a real problem; such as, overload on assessment as a consequence of greater student numbers.

Amongst the non-managers, academics across both institution types identified pragmatic approaches as powerful drivers for change. A number identified the potential for computers to address time and workload issues which are associated with providing adequate feedback and assessment of student learning.

*"The biggest time constraint on a academic who's involved in teaching [is] assessment, … a real high priority that the technology can be used to underpin assessment, so that we can use computer-aided assessment basically. …We very strongly believe that if you develop the software properly and write the questions intelligently, you can put really quite challenging questions that will require integration of information, understanding of information, application of information,… it could be very, very efficient in that sort of delivery".*

Computer systems such as managed or virtual learning environments were seen also as a means of solving problems such as reaching off campus students and

accommodating mixed attendance patterns. However there were also reservations about the institutional preferred learning environment.

Managers who took a pragmatic approach looked to capitalising on local activities that were started by teaching colleagues.

“We have put a tremendous amount energy into the development of CAA”. Was just one example where small local services such as assessment and learning environments were then pursued at an institutional level based on the positive experience of the trailblazer.

## 10.4 Working Methods: Formal and Informal

All institutions observed have both formal and informal structures and lines of communication. The chain sampling approach elicited responses which pointed to individuals with specialist knowledge and understanding. These people were individuals with formal roles or responsibilities such as professional managers, institutional managers and members of support services. It also elicited responses pointing to individuals who had special experience, skills, understandings or ways of working which was acknowledged, although they may not have been formally part of the organisation structure.

During the course of the interviews it became apparent that a useful distinction could be drawn between the **‘champions’** who had formal responsibility for initiating or furthering the use of learning technologies, and the **‘trailblazers’** who had no formal responsibility, but whose activities extended the use of learning technologies in the institution.

There was also an overlap between these, the formal and informal areas where those who had previously been informally recognised had moved on to take semi-formal institutional roles – typically through participation in committees, task groups, working groups or inter-professional teams. This role was most prevalent in the mixed management type of institutions where centralised and devolved systems of management exist side by side.

In the case of trailblazers, some of whom had been inward facing and were subsequently given formal institutional responsibilities, had moved into the role of

champion. In these cases their influence was often strengthened by their real understanding of issues relating to the use of technology, either from a technological or an educational perspective.

In addition it was observed that the work of formal structures such as committees, working parties or cross-institutional teams were augmented by informal networks, ad hoc teams, professional cultures and research expertise.

The importance of formal roles has been acknowledged in project management methodologies, and indeed in one institution which had introduced formal project management techniques some individuals were formally designated the role of project sponsor.

The value of formal and informal networks to support change was acknowledged, for example

> *"all faculties have a dean of teaching and learning, and that gives me a tremendous network right into the faculties, so I can sit here writing policy papers to go to academic board and get voted through and previously it was over to the dean,.... now the associate deans take things forward and they have been a tremendous conduit".*

But it was also acknowledged that such work needs additional informal support:

> *"This place works a lot on informal structures, our QAA audit explicitly commented on it. We are a big institution across a number of campuses…. it has been quite successful at getting some change, formalising through committees, through academic board and senate, but we got there because of informal development …I am a great network person; they help you develop the ideas and be an advocate, rather than be just managerial".*

## 10.5 Capacities, Identity, Values and Capabilities

Identity, beliefs, values and capabilities are important contributors to the culture and climate of an institution. Identity can relate both to institutions and the individual. Interviewees at institutions which were teaching intensive tended to express a more coherent understanding of institutional identity that those at the research intensive institutions. Academics with a strong research perspective appeared to be most

remote from the institutional identity. This was expressed through equivocal language and through gentle criticism of their institutional approaches as was suggested in the quotation under strategy above.

> *"Everything we do needs to be informed by pedagogy. We all believe;, [and] that's something that is close to our hearts, that even with these projects; if somebody comes along and says "I'd like to make a video that's delivered via the web, can you do it?" We'll say "yes, we can do it from a technology perspective, but we're gonna spend a lot of time discussing why you're doing it and how you think …. what your aims, objectives are, how we're gonna evaluate it".*

Individuals expressed strong personal beliefs

> *"at the end of the day, my real concern is what happens to the students"*

A number of institutional managers referred to excellent feedback from the QAA as a result of their institutional review, and proudly pointed to activities which had been identified as good practice in the review reports. Typically the item which had been noted had a pedigree which included

- inclusion in a relevant strategy document,
- development of an associated policy, and
- implementation through a clear tactical understanding of the change in practice which the activity was designed to address.

Examples here include the use of distributed support mechanisms for learning and teaching enhancement activities, the embedding of e-learning development processes within quality assurance procedures and the integration of learning technology support into other more mainstream institutional practices.

Where managers were aware that strategies, policies, procedures or tactics had resulted in real change in activities, examples were given with pride. Similarly individual non-managers, academics and support staff alike, would volunteer examples of their favourite tactic; motivating change they believed to be good by working indirectly or using *"stealth"* was a frequent theme.

A commonly forwarded belief referred to technology as a tool: this view extended across institutional managers, profession managers, academics and support professionals.

> *"My background is in systems development, and as I said earlier on, I don't believe in IT or systems for the sake of it. …So I always tend to think that you need to have the people who are really involved in whatever the process is, whether it's teaching, research, management, what have you; you need to have those people engaged in developing the technology, because that's the only way that technology is going to meet people's needs".*

Other trailblazers whose activities were either more outward facing or more deeply motivated by research did not move into the more formal role. The latter group were found in both research intensive and teaching intensive institutions. However their analysis often reflected a commitment to the theory, and in their language, the latter group often appeared to be more equivocal.

As might be expected, individual responses tended to reflect the responsibilities associated with the roles which the interviewee undertook; however, consistent themes did emerge from individuals in differing roles across the same institution.

Operational managers, typically drawn from the professional services such as a library or computing centre, tended to be more inwardly focussed than their Chancellery team counterparts such as Pro Vice Chancellors and Deputy Vice Chancellors who identified strongly with their institution and tended to demonstrate a sensitivity to the attainments of comparator or competitor institutions.

Trailblazers tended to have quite an individualistic identity, they had frequently pursued ideas and approaches and been rewarded by grant funding. For example

> *"I've had grants ranging from, I think the smallest one was, you know, really quite small, six or seven thousand pounds, sort of in the mid to late '90's, and then the most recent one, quite a lot of money, about twenty-three thousand pounds, for a project that has, you know, had a major impact across a whole programme".*

Many had roles which were outward facing, this perspective often arising as a consequence of external funding either from research councils or because of the

technology focus of the activities they work with, via the JISC. Others worked with local agencies and brought in consultative work, and along the way found themselves at odds with the institutional infrastructure.

> *" Another reason we don't use the university system! We do lots of courses off campus, but they need to be able to log in to things, you know, well, we couldn't do it via the VLE because we'd have to get them registered with the University, then they'd have to be issued with an id and password, and ….. nightmare!"*

## 10.6 Organisational Units: Centre, Services, Departments, Academics

Acknowledged organisational structures in the various institutions studies ranged across a wide spectrum. At one extreme, institutional structures comprise tight, centralised management with a directive individual leadership through to institutional structures where management was loosely coupled by a mixture of centralised management approach, with budgets and responsibilities devolved to the faculty or school level. Most institutions had undergone recent change either in terms of the recent (within three years ) arrival of a new vice-chancellor which then resulted in changes in organisational structure, or management re-organisations prompted by an institutional desire to address specific operational objectives. As well as organisational restructuring there were instances of changes to the organisation and management of the teaching structures. Although the changes were only observed in six institutions, they were consistent with practices across the wider Higher Education community. Some references were made by observers of the change to the fact that methods appeared to have migrated between institutions as a result of the new leadership's previous working experiences.

Many institutions had converged information services encompassing centralised computer provision, library and management information systems support. Typically, managers of such services and major professional services, such as centralised computing and library services, had a role in the executive of the institution.

Other typical centralised provision included centres which covered staff development, educational development, student support, and learner support. From the central

perspective the skills and activities of subject librarians were valued, and their contribution to technology based learning support was widely recognised.

Central services which were responsible for staff development, educational development and learning support, frequently contributed to the professional training of higher education teachers. Masters level units were studied by new academics at all participating institutions. In some cases, in teaching intensive institutions they were also studied on a voluntary basis by established staff. Professional concerned with these courses pointed to the ways in which such programmes provided a stimulus for the building of teaching skills which could make active use of learning technologies.

In a research intensive institution, an academic with a strong research interest in learning technologies reflected on the effectiveness of the central support established in their home institution

> *"What we don't have in this University is any kind of Unit around educational development that actually employs academic staff…which in my view is, rather a gap. You know, I think it would be helpful if our strategic development within the University was underpinned more explicitly by research".*

In another similar institution, there were feelings amongst service providers that funds made available to faculties could perhaps have been used by the centre.

> *"And the other thing that's interesting is that there has been other money that's come through from HEFCE Teaching and Learning funds and things like that, and that tended to have been disbursed, or at least distributed to Faculties and Departments. Not that that's a bad thing to do, because that means it gets to actually where it might be needed on the ground, but it does mean that from my point of view. If I've got people coming along and saying well, you know, we want to provide some centrally supported service, then there might have been funds we could've used in that way, but we've taken the decision, as I say, to disperse them".*

This interviewee went on to acknowledge a fairly typical view of the gap between central services and academic departments

*"they see themselves as entirely self-sufficient and to some extent they see us as a bit of a curse, because we're a central service which they have to pay for in some way".*

Sometimes there were gaps expressed between the motivations of the service and the perspectives of the academics

*"I'm going to sound quite righteous now… the support service, they're going to come up front with the pedagogy card for why we should be doing this with missionary zeal, whereas I'd give you more a pragmatic reason why we should [because] they're not engaged with the actual delivery of our learning".*

When looking at technology across the disciplines it was not always the technologically led subjects which were cited as the most active, as mentioned by one of the managers in a teaching intensive institution:

*"one of the best advocates of e-learning is one of our English lecturers"*

An academic from another institution commented

*"[The department of] Architecture, use a lot of technology in their teaching. The Environmental Sciences use quite a lot in their teaching. Interestingly, the Maths and Computing Sciences, they do a lot of lecturing in lecture theatres and they use PowerPoint".*

At another institution, there was some understanding of another sort of tension and pointing to disciplinary differences

*"one that sort of springs to mind… they might not necessarily see the need for Blackboard, but that's not because they're sort of Luddites or against the technology. It's actually quite the reverse for them because they know how to do it themselves and they don't need help from anybody else, thanks very much! … they see themselves as entirely self-sufficient and to some extent they see us as a bit of a curse, because we're a central service which they have to pay for in some way, so you get people like that on one level who are actually very well provided for and are very self sufficient and have got the skills to deal with the technology, and then perhaps people at the other end, maybe in some of the Arts and Humanities areas where there isn't the money,*

*there isn't the time, so they struggle, and I think things have moved on, [because we began] putting new web enabled systems out there"*

## 10.7 Conclusions

This chapter has presented detailed accounts of the experience of technology at an institutional level. The interrelationship between structure, organisation, culture and climate has been demonstrated.

Mechanisms for change vary according to the type of institution, and it is useful to differentiate between strategies, policies and processes and tactics. Individual champions and sponsors can have differing impacts, and there is a strong need to recognise the differences between formal and informal working methods. Institutions ability to change can also be dependent upon the capacities of the individuals and organisational units within the institution. Organisations often respond to the need to change by changing the formal structure but understanding and nurturing informal communication channels and the institutional and individual capacities may be more important in bringing about effective change. The creation or arrangement of organisational units can be highly influential in assisting and sustaining an institutions ability to change

# Chapter 11 Reflections

This chapter brings together reflections on the institutional studies and broader considerations of the theoretical frameworks explored Chapter 7 Change and Innovation. It analyses the meaning of the key concepts which emerged from the interviews. It considers them within the initial theoretical framework drawing from McNay and Geoghegan.

## 11.1 Introduction

A number of conclusions emerged which may be interesting for further consideration. One key area is the relationship between sponsors, who are in a position to motivate or initiate change at a directorial level and between those involve in implementation – champions who can influence from the top down and trailblazers who can provide exemplars from the bottom up. Another important consideration is the way in which possible relationships between pedagogy and technology can be established and exploited. Such relationships may be catalytic of future change, or they may be symbiotic. From both of these perspectives individual institutional differences need to be taken into consideration. Factors such as the nature of the prime mission, key sources of income, or the academic and research priorities of academic groupings can make significant differences to the nature and progress of change. These consideration are discussed in greater detail in the sections which follow, they are set in the context of first the evidence of the institutional studies and finally the merging of the theories and evidence gathered. The final section looks at future work.

## 11.2 Sponsors, Champions, Trailblazers

The functional difference between the role of Champions who have formal roles, ideally budgets and certainly the ability to introduce systematic approaches seems to be an important one. Thus effective champions are sponsors and leaders. In the institutions which had the most widespread use of technology the champions came from a strong technological background. In institutions which had made less progress such champions tended to be found in the professional services. Their accounts reflected the fact that change takes place in the context of institutional compromises. This is evidenced in the view of an institutional manager quoted in section 10.3 mechanisms (tactics) when speaking of spending of teaching quality funds, and the

professional manager talking about the tension between central services and faculty activities quoted in section 10.2 on organisational structures.

The less formal managerial approach taken by research intensive institutions means that typically managers come to the task directly from their disciplinary background. In contrast, in teaching intensive institutions high level managers have progressed through a formal managerial route (like the professional services across all institutions). It may be that this difference leads to tensions between professional services and higher management in those institutions which have mixed routes to leadership. If power and money are important, so too is professional expertise, although it may be a challenge to make effective use of such expertise.

Champions who made change happen spoke proudly of the work they had done; similarly, trailblazers in non-managerial roles were keen to promote the successes they had achieved. Institutions who appeared to have the greatest amount of learning technology systems in use had made use of high achieving trailblazers by involving them in institutional initiatives to take forward learning technologies. Where institutional change was less visible, trailblazers often appeared to be more detached in their relationship to institutional policies.

The approaches adopted by champions can be classified as the tools of systematic change. They stretch across strategies, policies procedures and tactics. The approaches adopted by trailblazers (and, it appears, professional specialists) can be classified as systemic. They are tied to the context of their use, be that an academic discipline or a professional service. Where the greatest progress is made in technology for learning, there is the sense of a strong link or alignment between the activities on the ground and the objectives and policies of the institution.

## 11.3 Pedagogy and Technology

Many interviewees talked about technology as a tool, and were pragmatic about the way in which technology was implemented. A number of interviewees referred explicitly to the relationship between pedagogy and technology as expressed by one non-manager engaged in supporting learning technologies on campus.

*"But the technology's not important in our view; it's really the case that everything we do needs to be informed by pedagogy".*

Similarly a professional manager commented:

*"We don't do staff development. We have established a procedure which requires approval for quality assurance. No e-learning is created without consultation with us. We provide advice and guidance; this is about pedagogy, not technology".*

It may be that this is an orthodoxy, but it may also reflect the understanding of professionals actively engaged in implementing and supporting technology, as opposed to the perhaps more abstract understanding of those institutional managers whose primary concern is closer to strategy than implementation.

## 11.4 Institutional Differences

In the course of the interviews it became clear that in many contexts there are less differences between the teaching intensive and research intensive institutions than is commonly believed; However, real differences exist between the approaches of the two institution types because of the reality of limited funding (tight resources) in the teaching institutions, where there is a clear reliance on teaching to generate funds. In research intensive institutions, the institution as a whole may be relatively wealthy, but devolution of budgets may mean that in individual schools or faculties where teaching is a stronger source of income than research the local economy may be relatively poor.

There were cases in the research intensive institutions of wealthy departments or faculties engaging in large scale technology for learning – motivated by strong, perceived educational needs – either handling large student numbers or dealing with learners off-campus. There were also instances of relatively poor schools or departments where use was made of centralised infrastructure to use technology for teaching.

These are examples where opportunity exists for an alignment of, or link between, work going on at the centre and work across the institution.

One objective of this thesis has been to bring together a number of different research threads in three areas:

- The use of learning technologies in higher education
- Factors which influence uptake of technology
- Organisational structures and change

This work therefore examined these three research areas and undertook new research which was designed to explore ways in which these three areas of study might be usefully considered in an inter-related manner. In earlier chapters the study has examined details of these threads; specifically, the extent to which: The growth of the use of technology for learning has been driven by the affordances of available technology

- The growth of use of technology for learning has been driven by a desire to encompass prevalent educational approaches
- The steady growth of the use of technology in an institution is driven by available technology, but constrained by conflicting priorities
- The evidence of experience in areas beyond learning technology might suggest the source of drivers and barriers which accelerate or inhibit the uptake of technology
- The existence of theory which classifies educational institutions according to their organisational structures and management culture can contribute to our understanding of processes of institutional change

## 11.5 Interim Conclusions

Interim conclusions which were reached are as follows:

In chapters Three to Six it was demonstrated that, although it is still not the only, or most prevalent method employed, technology has been used in teaching and the support of learning over a long period of time. There has been a steady development of learning technologies supported by the work of researchers and educators. It has been used for teaching and training at all educational levels in schools, universities

and workplace learning. The ways in which learning technologies have developed have been influenced by the affordances of the technology, prevalent understandings of student learning and the predominant approaches to educational and psychological research.

The particular experience of the use of learning technology in UK Higher Education has been influenced by a variety of government initiatives which continue to this day. Over time, the understanding of what can be achieved by learning technologies has changed. Particular approaches have been adopted by particular disciplines where there is a good match between activities supported by a method and the skills and knowledge processes associated with the discipline.

Chapters Six and Seven look at a range of theoretical approaches. The chapters went on to discuss the possible inter-relationship of the different theoretical understandings of the processes which effect change. The analysis focused on models which have particular relevance, in the context of Higher Education, to the use of technology for education or the process of institutional change.

Chapter Eight examined data collected over a ten year period at the University of Southampton which indicated members of staff's attitudes to and uses of technology in teaching and the support of learning, and began to analyse the responses in the context of the theories examined in the previous chapter. The analysis pointed to a possible conclusion that:

> *"**Organisational factors may amplify or dampen the effect of known barriers and drivers, thereby influencing the effectiveness of the uptake and use of technologies in teaching and the support of learning".***

Taken together the evidence of the early chapters tended to confirm that there are clear drivers of the use of technology in Higher Education which are particular to the sector; however, since it has been observed that technology for learning and teaching has not become ubiquitous, perhaps there also exist factors which are particular to Higher Education, and which inhibit this change.

The quantitative data collected at the University of Southampton suggested that some change in attitudes and use had taken place over time. The qualitative data

collected at the same time suggested that academics' perception of conflicting priorities inhibited the uptake of new methods. The next stage was to consider these suggestions from an institutional and strategic perspective

## 11.6 Institutional Studies

The objective of the studies analysed in Chapters Nine and Ten was to collect data across a range of institutions which could be used to build a picture of the experience of change within a range of UK institutions. This would be used to help ground the theory which had been developed in the preceding chapters. The institutions were broadly categorised into teaching-intensive and research-intensive, although it was noted that the issues experienced in institutions were largely influenced by similar factors.

It became clear in the course of the interviews that, irrespective of the institutional type, there was a similarity in the experiences of individuals according to the functions they performed in the role which they undertook in their institution. These roles could be either formal, informal or a mixture of both. There were two important categories of interviewees who influenced change.

1. champions who were in a position to lead change from the top down such as institutional managers and professional managers
2. trailblazers who were in a position to implement new methods from the bottom up such as academics and professional support staff

An important factor in the motivation of institutional change was observed in teaching-intensive institutions which were more financially constrained than their research-intensive counterparts; furthermore, interviewees in the teaching intensive institutions typically exhibited a greater awareness of the institutional mission. In particular the local agendas were stronger in the teaching intensive institutions.

Academics across all institution types exhibited a strong allegiance to their disciplines, and members of professional services identified strongly with the values and professional practices of their specialist area.

## 11.7 Merging Theories and Practice

In order to assist the analysis and the merging of different areas of theory a number of visual representations of the information space were created which are represented in the figures below.

Beginning from the original definition of four cultures used by McNay (McNay, 1995) An initial representation which has previously appeared in Chapter Eight was considered.. For ease of reference It is shown below (29).

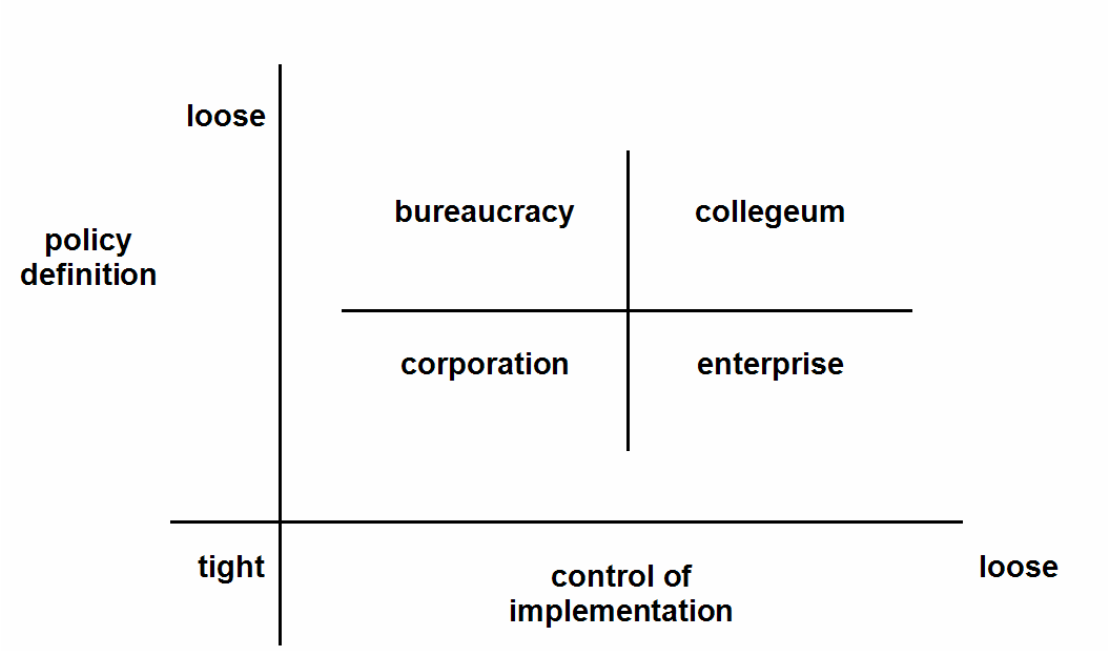



**Figure 29. The Four Cultures of the University (McNay, 1995)**

This initial representation takes at its core the four approaches to organisation found in Higher Education: collegial; corporate; bureaucratic and enterprise, as discussed by McNay. Although every institution will incorporate a mix of these approaches, it is possible to typify the possible causes and consequence of the approaches which are found as discussed in Chapter Seven, Change and Innovation.

This view is important because it draws attention to the argument that an institution's ability to change will be affected; accelerated or inhibited, because of drivers or constraints which are a consequence of its organisational structure.

The next perspective which was considered relates specifically to the uptake of learning technologies. When Geoghegan asked "Whatever Happened to Instructional Technology?" (Geoghegan, 1994b) he compared Moore's "Crossing the Chasm" observation of the key success factors for technology based companies (Moore, 1991) to those which impacted on the uptake of instructional technology. Geoghegan suggested that to achieve widespread change in practice it was necessary for implementers to adopt approaches which would be effective for the early majority. Factors which enhanced the appeal of innovations to the early adopters were not the same as those which held sway with the early majority. He suggested therefore that the use of learning technology would be more likely to become embedded when the technology or its providers addressed specific preferences of those individuals or groups who would form the early majority of users. The factors are summarised below (Table 16).

**Table 16. Early Adopters vs. Early Majority (Geoghegan, 1995)**

| Early Adopters | Early Majority |
|---|---|
| • like radical change<br>• visionary<br>• project oriented<br>• risk takers<br>• experimenters<br>• self sufficient<br>• relate horizontally | • like gradual change<br>• pragmatic<br>• process oriented<br>• risk averse<br>• seek proven uses<br>• need support<br>• relate vertically |

Having taken these two views into account and reflecting on the data collected in the case study interviews an additional model was drawn (30) which combined some parts of the two models by McNay and Geoghegan and considered the role of external drivers in the UK higher education context. The diagram is not definitive, but is included to demonstrate the thought process which was to be developed in greater detail subsequently.

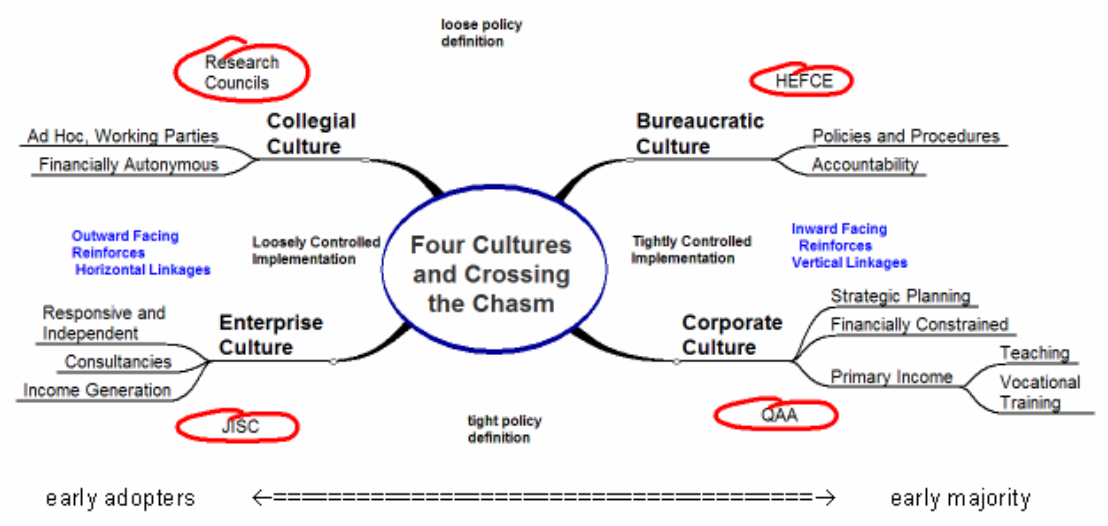



**Figure 30. Mindmap Showing Four Cultures and Crossing the Chasm**

Interviewees in the case study exemplars all mentioned external drivers. The history of learning technologies in the UK and the wider community has benefited from funding from a range of external sources.

The four external sources most frequently referenced were:

- The Funding Councils (specifically HEFCE since all institutions were English)
- The Quality Assurance Agency (QAA)
- The Joint Information Systems Committee (JISC)
- The Research Councils

As is suggested in the diagram each source exerts influence in a different way and may have greater or lesser importance with different audiences.

In the diagram the activities of the early majority are seen on the right hand side, while the early adopters are placed on the left hand side.

Briefly, the reasoning for the positioning of the external drivers (encircled) is as outlined below.

### 11.7.1 Early Majority

Beginning with the Bureaucratic Culture, external funding bodies such as HEFCE seek to shape institutional activities by directing their monies, by promoting specific initiatives through ring-fenced spending (such as the TQEF funding, which was recognised in interviews as being significant), by requiring policies and procedures as well as monitoring for accountability.

Mainstream funding council activities relate to a Corporate Culture. Funding council involvement lies behind the Quality Assurance Agency (QAA) and the Higher Education Academy. For the period of the study, the QAA has been a more significant player in determining external drivers for institutions. The QAA does not provide explicit funding but seeks to steer practices through its requirements, inspections and expectations in terms of policies and procedures. The QAA is also a mechanism for government policy, but it necessarily has greater impact on those institutions where the larger part of activity and income generation is through teaching activities. Activities and requirements of the funding councils and the various authorities concerned with the regulation of teaching have a greater impact on the activities of the early majority.

### 11.7.2 Early Adopters

The project focussed activities engendered by the research councils and the JISC impact most directly on the activities of the early adopters. From the institutions interviewed the JISC was most commonly referred to as a source which would stimulate activity in learning technologies. Research council activities affect institutional e-learning activities only marginally, but can be recognised in the context of institutional drivers and barriers as a core to many institutional activities in the extent that they enable financial autonomy, for individuals, teams, schools, departments and faculties; and ultimately, whole institutions. The extent of this autonomy varies as does an institution's research strengths and priorities.

The JISC direct funding, manages and funds a wide range of initiatives under the e-learning banner. Alongside project funding, the JISC has also taken responsibility for providing technological infrastructure, generating policy guidance documents and initiating strategic planning projects. The JISC, therefore, sit in the enterprise area

(through projects which stimulate outward facing activities and horizontal associations) and attempt to sit in the bureaucratic area (though their work with information system managers and their production of guides and strategic planning guidance).

The picture is more complex than this argument because of the inter-relationship between the JISC and the funding councils (in the case of the case studies HEFCE was the only funding council involved).

### 11.7.3 A more elaborate model

The view provided via the mindmap is indicative, showing some clear lines of influence which need to be taken into account if attempts are to be made to theorise drivers and barriers in UK Higher Education.

This initial diagramming prompted an attempt to draw a more integrative picture of the whole area using a concept map approach (Figure 31). The diagram takes as its core in purple the balance of cultures proposed by McNay. Around this core, grey boxes indicate major external influences. Pale green boxes indicate experiences which emerged consistently during the interviews. The pale grey boxes introduce concepts from Geoghegan's model and place them alongside the experience reported in the case studies.

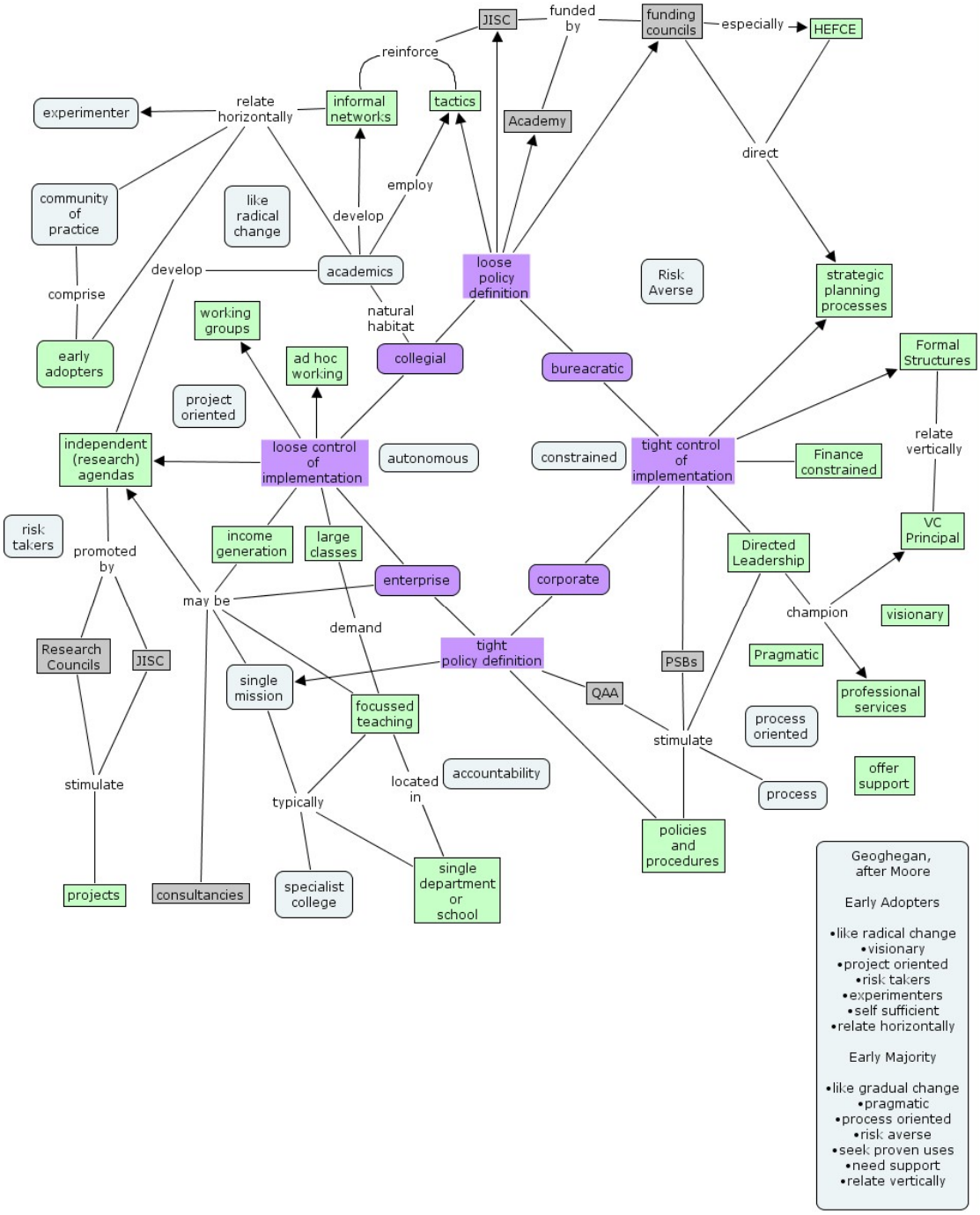



**Figure 31. Concept Map of Four Cultures and Crossing the Chasm**

The most significant observation is the way in which academic practice found in all institutions (and thus academic culture) supports behaviours which are typical of the

early adopters whilst corporate behaviour, which is found more in the teaching intensive institutions, supports behaviours which are typical of the early majority.

One area of teaching which might be found in both research intensive and teaching intensive institutions is that of focused teaching, which may be brought about by ambitions of significant income generation from teaching, or through large student numbers (as in the case of popular or necessarily large teaching areas such as medicine and nursing). In these instances, academics involved in learning technologies could experience tightly controlled policy definition and tightly controlled implementation conditions, and therefore are more likely to fall into the area of the early majority.

## 11.8 Future Work

It would be useful to further explore the potential similarities of experience within sub-sections of research intensive institutions and to compare them with the experience of the teaching intensive institutions.

This type of study could be further elaborated by examination of the experience within specialist single mission institutions such as specialist colleges in art and design or business.

It has been observed that areas such as medicine, nursing and business have strong motivations to the use of technology in teaching and learning. These may be comparable with single mission institutions and thus largely within the enterprise area in McNay's model.

In addition there seem to be some academic areas within the arts, humanities and social sciences which are particularly able to benefit from technology affordances. This seems to be due to the match between the academic processes developed through university education in these areas and the organising capabilities offered by technology applications.

The area in which the conclusions of this work may best be able to make a contribution is in providing help in guiding the decision maker towards the understanding that gaining a better understanding of the particular circumstances of

an institution may be especially useful in identifying better paths to change whilst avoiding pitfalls which may arise as an integral part of the larger academic process.

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