New theoretical frameworks of learning activities, learning technologies and a new method of technology selection

Richard Caladine
University of Wollongong
New Theoretical Frameworks of Learning Activities, Learning Technologies and a New Method of Technology Selection.

A thesis submitted in fulfilment of the requirements for the award of the degree

DOCTOR OF PHILOSOPHY

from

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by

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BEng, BA

School of Information Technology and Computer Science

2003


I, Richard Caladine, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the School of Information Technology and Computer Science, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Richard Caladine
30 June, 2003
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<tr>
<td>categorisation</td>
<td>grouping according to the role played</td>
</tr>
<tr>
<td>classification</td>
<td>grouping according to similar or like characteristics</td>
</tr>
<tr>
<td>dialogic</td>
<td>pertaining to a dialogue – a technology designed for the mediation of dialogue</td>
</tr>
<tr>
<td>Distance Learning</td>
<td>(or Distance Education) Education in which learners are separated from Facilitators</td>
</tr>
<tr>
<td>education</td>
<td>A structured program of Intentional learning from an institution</td>
</tr>
<tr>
<td>facilitator</td>
<td>the person who has prime responsibility for the</td>
</tr>
<tr>
<td></td>
<td>facilitation of the learning rather than terms such as “teacher”, “trainer” or “developer”</td>
</tr>
<tr>
<td>Flexible Learning</td>
<td>An approach to learning in which the time, place and pace of learning may be determined by learners. In this thesis this term is used to include the approaches taken by Distance learning and Open Learning</td>
</tr>
<tr>
<td>Higher Education</td>
<td>Intentional learning in Universities and Colleges</td>
</tr>
<tr>
<td>Human Resource Development</td>
<td>Intentional learning in organizations. Can include training and development</td>
</tr>
<tr>
<td>Instructional Design</td>
<td>The process of is concerned with the planning, design, development, implementation and evaluation of instructional activities or events and the purpose of the discipline is to build knowledge about the steps for the development of instruction</td>
</tr>
<tr>
<td>Interaction</td>
<td>Reciprocal between humans and between a human and an object including a computer or other electronic device that allows a two-way flow of information between it and a user responding immediately to the latter's input</td>
</tr>
<tr>
<td>learner</td>
<td>A generic term to describe the person learning, rather than terms such as “trainee” and “student”</td>
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<td>learning</td>
<td>an umbrella term to include training, development and education, where training is learning that pertains to the job, development is learning for the growth of the individual that is not related to a specific job and education is learning to prepare the individual but not related to a specific job (Wilson 1999)</td>
</tr>
<tr>
<td>learning activities</td>
<td>the things learners and facilitators do, within learning events, that are intended to bring about the desired learning outcomes</td>
</tr>
<tr>
<td>learning event</td>
<td>A session of structured learning such as classes, subjects, courses and training programs</td>
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<tr>
<td>learning technologies</td>
<td>Technologies that are used in the process of learning to provide material to learners, to allow learners to interact with it, and/or to host dialogues</td>
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Representational Technology  A one-way technology that supports interaction with the material

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<thead>
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<th>Role</th>
<th>Description</th>
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<td>student</td>
<td>A learner in an educational institution</td>
</tr>
<tr>
<td>teacher</td>
<td>A facilitator of learning in an educational Institution</td>
</tr>
<tr>
<td>trainer</td>
<td>A facilitator of learning in an organisation</td>
</tr>
<tr>
<td>trainee</td>
<td>A learner in an organisation</td>
</tr>
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A Note on Capitalisation.

When individual technologies are discussed where possible the first letter is capitalised or not depending on convention in the literature. In many cases, where technologies are young the convention may be emerging. For example “email” is commonly used for “electronic mail” but “Internet” appears to be accepted convention. “World Wide Web” is generally capitalised but “web” is also common in the literature. For the discussion tools, “Chat”, “Online Discussion” and “Listserver” the convention appears to be to retain the capital.
## Abbreviations, Acronyms and Initials

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<th>Abbreviation</th>
<th>Description</th>
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<td>ASCII</td>
<td>American Standard Code for Information Interchange</td>
</tr>
<tr>
<td>ALT</td>
<td>Analysis of Learning Technologies</td>
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<tr>
<td>CAI</td>
<td>Computer Aided Instruction</td>
</tr>
<tr>
<td>CAL</td>
<td>Computer Aided Learning</td>
</tr>
<tr>
<td>CBT</td>
<td>Computer Based Training</td>
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<tr>
<td>CD-ROM</td>
<td>Compact Disc-Read Only Memory</td>
</tr>
<tr>
<td>DVD</td>
<td>(was Digital Video Disc and then Digital Versatile Disc but now is simply DVD)</td>
</tr>
<tr>
<td>FAQ</td>
<td>(list of) Frequently Asked Questions</td>
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<tr>
<td>GUI</td>
<td>Graphic User Interface</td>
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<td>HRD</td>
<td>Human Resource Development</td>
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<td>HRM</td>
<td>Human Resource Management</td>
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<tr>
<td>HTML</td>
<td>HyperText Markup Language</td>
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<td>JIT</td>
<td>Just in Time (training)</td>
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<td>IA</td>
<td>Intra-action</td>
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<tr>
<td>IF</td>
<td>Interaction with Facilitator</td>
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<tr>
<td>IM</td>
<td>Interaction with Material</td>
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<tr>
<td>IL</td>
<td>Interaction Between Learners</td>
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<tr>
<td>LAM</td>
<td>Learning Activities Model</td>
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<tr>
<td>LMS</td>
<td>Learning Management System</td>
</tr>
<tr>
<td>LTM</td>
<td>Learning Technologies Model</td>
</tr>
<tr>
<td>ODFL</td>
<td>Open, Distance and Flexible Learning</td>
</tr>
<tr>
<td>pdf</td>
<td>Portable Document Format</td>
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<tr>
<td>PM</td>
<td>Provision of Materials</td>
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<tr>
<td>SCEN</td>
<td>South Coast Education Network – the satellite campuses of the University of Wollongong</td>
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<tr>
<td>TBT</td>
<td>Technology-Based Training</td>
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<tr>
<td>TLA</td>
<td>Three Letter Acronym</td>
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<td>TSM</td>
<td>Technology Selection Method</td>
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<tr>
<td>WBT</td>
<td>Web-Based Training</td>
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<tr>
<td>Web</td>
<td>WorldWide Web</td>
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<td>World Wide Web</td>
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Publications that Relate to this Thesis


Caladine, R. (2002) CUPIDs: *Collaborative, User-Produced internet Documents*. An application (successful) for funding from the Educational Strategies Development Fund of the University of Wollongong (internal document)


Other Publications by the Author


Dean, A.F. and Caladine, R. (1997) Towards a Collaboratively Developed Case Study Based Theory of Distance Education Proceedings of the International Council of Distance Educators, 18th World Conference June 1997.

NTEU (1996) How to Compile a Teaching Portfolio" 3rd edition revised by myself to include flexible delivery. NTEU: Melbourne


Abstract

Traditionally, the design of learning events was part of the role of teachers and trainers and in the past when learning technologies were part of teaching and learning events, for example in Distance Education or Open Learning, specialist Instructional Designers typically undertook the design. Information and Communication Technologies (ICTs) are now central to learning in many contexts and no longer can specialist designers meet the high demand to design the vast number of technology-centred learning events in Higher Education and Human Resource Development. Most teachers and trainers are not equipped to undertake the selection of learning technologies but there is a growing expectation that they do so in the design of technology-centred learning events.

In order to enhance the experience of learners or to gain efficiencies, a number of disciplines have engaged in attempts to match technologies to learning events, in particular Management, Education and Instructional Design. Theorists from each of these disciplines have proposed different models and frameworks for understanding the technologies used in the learning process, and the way in which technologies for the learning process are selected.

This thesis evaluates these models, explains their deficiencies and puts forward new theoretical frameworks for the activities of the learning process, learning technologies and a method for technology selection.
The new theoretical frameworks are called the Learning Activities Model (LAM) and the Learning Technologies Model (LTM).

The Learning Activities Model is based on the argument that the activities of the process of learning can be categorised as provided materials and interactions. The model further divides interactions into four sub-categories:

- interaction with materials,
- interaction between learners,
- interaction with the facilitator of learning (or teacher), and
- Intra-action, a new term coined by the author to describe learning activities not included in the other categories such as reflection, refinement of opinion etc.

The literature of the disciplines of Instructional Design, Human Resource Development, Flexible, Open and Distance Education is surveyed to support this argument.

The basis of the Learning Technologies Model is provided in part by researchers in the field of Distance Education through their description of learning technologies as one-way or two-way. However, the research reported in this thesis takes this rather basic conceptual approach, redefines it and juxtaposes it with theoretical analyses developed for media selection in Organisational Communications to produce a new theoretical framework within which learning technologies may be analysed and categorised in the two dimensions of:
- one-way or two-way, and
- levels of communicative attributes, such as textual, aural and/or visual.

This theoretical framework is then expanded by the inclusion of two further criteria. These are the suitability of each technology to categories of the Learning Activities Model and their ability to support synchronous or asynchronous interactions.

The Technology Selection Method uses the above theoretical frameworks to match learning technologies to categories of learning activities and, through a four-step process, provides a practical method of technology selection that is simple enough to be used by trainers and teachers who are not Instructional Design specialists and yet robust enough to be used in many subject areas in both the Higher Education and Human Resource Development contexts.

The theoretical frameworks have individual uses that are beneficial to trainers, teachers and learning designers as they provide frameworks within which learning activities and learning technologies can be analysed. As well, when they are brought together into The Technology Selection Method they form a method that enables the design of learning events that use learning technologies in a manner that is appropriate to the material, the learners, the context and the budget.
Chapter 1

Introduction.

1.1. The Historical Development of Technology in Learning in the Late Twentieth Century.

Learning has been defined as the acquisition of new skills attitudes and knowledge (Nadler and Nadler 1994) and intentional learning has been defined as an experience that consists of specified outcomes, a time set aside for learning that is determined by the individual, the institution or the organisation, and some form of evaluation. This thesis is concerned with intentional learning and for the sake of simplicity the term “learning” will be used to indicate “intentional learning”. In most of its contexts, learning is undergoing changes that are probably the most significant since the development of the printing press. At the centre of these changes is the altered role of technology in learning. The combination of new and existing technologies has affected the place, pace and time of learning and has created new roles for technology that are central to the process of learning. Nowhere are these changes being felt more acutely than in Higher Education, or learning in universities and colleges, and Human Resource Development or learning in organisations. These areas have
embraced the use of Information and Communications Technologies (ICTs) as central to the learning process.

Two of the more traditional technologies associated with learning are the chalkboard and printed materials. In the twentieth century, as technologies of mass communications and ICTs became part of life for most people in developed countries, this trend was reflected in learning. In the second half of the twentieth century, mass communications technologies, and later ICTs, were used widely as adjuncts to the learning process. Late in the same century the role of ICTs in learning changed from that of adjuncts to one of centrality to the learning process.

In the 1990s, the flexibility of time and place of learning grew in significance to students, institutions and organisations. Managers of Higher Education, such as university executives, saw added flexibility as a way to increase participation rates without a concomitant increase in resources and staff. Human Resource Managers saw flexibility as a way for learning to occur when it suited the organisation or the task and hence maximise performance gains in an environment in which the learning needs had expanded due to the increase in information that characterises modern business (Rosenberg 2001). In both contexts the flexibility of time and place of learning was seen a way to achieve greater efficiencies.

When learning is flexible it differs from traditional face-to-face learning in two significant ways. Firstly the teacher’s or trainer’s voice is no longer the
prime channel through which information is supplied to learners.

Secondly, a system for mediation is necessary for interactions between learners, or with the teacher or trainer. Typically in flexible learning, Information and Communication Technologies (ICTs), such as web pages, email and Online Discussions are used in both these roles. For simplicity and as a reflection of their changed role the term “facilitator” will be used in this thesis to describe “teacher” and “trainer”.

The advent of the Internet in the late twentieth century, and its rapid growth into a pervasive and almost ubiquitous technology have made it a timely, efficient and affordable technology to foster flexibility in learning. The Internet, and more specifically, the World Wide Web, have provided ways to connect learners with other learners, materials and facilitators while maintaining a degree of flexibility of time and place of learning. The World Wide Web, when central to learning, enables the organisation, the facilitator and the learner some control over the degree of flexibility.

The use of the Internet and web-based learning environments has been widespread to the degree that new terms have been created. In the parlance of Higher Education, web-based learning is today generally referred to as “Online Learning”. As well, Human Resource Development has adopted new terms such as “eLearning” and “Web-Based Training” to describe the process and “learning technologies” to describe the tools. Evidence of the proliferation of Online Learning is indicated by the size of the market for Online Learning environments such as WebCT and
BlackBoard. Describing itself as “the world’s leading provider of e-Learning solutions for higher education” (WebCT 2001), WebCT claims that “over 2,600 institutions in 84 countries are licensed to use its learning environment.” (WebCT 2001a). As well the American Society for Training and Development recognizes the rapid growth in the use of the Internet for training.

“ASTD [American Society for Training and Development] found that the percentage of organisations using the Internet for training purposes grew from 3 percent in 1996 to 38 percent in 1999. For intranets the rate of growth was even higher, from 3.5 percent to nearly 40 percent.” (Commission on Technology and Adult Learning 2001, p 10)

While the World Wide Web is itself a technological system, it supports a group of functionally different learning technologies, many of which are either conceptually similar to, or adaptations of, older technologies or practices. This is reflected in their names, for example email, Internet Chat, video and audio streaming, Online Discussions and web pages. These are examples of some technological elements that when combined into a cohesive suite, form Learning Management Systems such as WebCT and BlackBoard. As these are Internet-based, access to them can have a degree of flexibility of place and time.
Two levels of decision-making, concerning the use of central role of technology in learning, have been identified (Bates 1995). At the level of the organisation or institution, senior management makes decisions of a strategic nature. These strategic decisions generally concern the acquisition, implementation and maintenance of high-cost, technological infrastructure, resources and equipment. At the level of the designer of individual programs of learning, for example the facilitator, other decisions are made, such as tactical decisions as to which technological elements of the Learning Management System, or what other technologies will be used for the planned activities that make up the subject, program or course.

The use of technology in learning is something of a two-edged sword. While there are benefits in access and equity to learners, such as flexibility of where and when they learn, there are new challenges in the design of learning events that make appropriate use of technology. The term “learning event” is used rather than class, subject, training session, etc. to reflect the available flexibility. Facilitators can see the benefits of flexibility to learners and there is a growing pressure on them to provide flexible, technology-based learning experiences. As learning changes from solely, face-to-face classroom experiences to being technology-based, new expertise in the design of learning events is required. To this end researchers in a number of related and overlapping fields have investigated learning, learning technologies and the selection of learning technologies with a view to creating learning events that apply
technologies in ways that are appropriate to the learners, the material, the context and the budget.

1.2. The Need for New Conceptual Tools.

Instructional Design has been described as a discipline and a process (Seels and Glasgow 1990) where the process is concerned with the planning, design, development, implementation and evaluation of instructional activities or events that facilitate learning. Facilitators generally do not have the individual resources or inclination to obtain training in the field of Instructional Design, unless of course they are teachers of Instructional Design. Institutions and organisations cannot or chose not to provide learning event design services en masse. However, facilitators are expected to undertake the design of technology-based learning events. They need to understand the relationship of learning technologies to the activities of the learning process if they are to design learning events that use technologies in appropriate, effective and efficient ways. At the tactical level of technology selection, as a single technology cannot generally be applied effectively to a course, program or subject, a framework of learning activities is required to which individual technologies, or technological elements of a Learning Management System can be applied. Likewise a framework of technologies that informs the designer and that facilitates the matching of technologies to activities is required. The activities framework and the technologies framework can then be combined to form a practical method for the selection of learning
technologies that are appropriate to the learners, the context, the material and the budget.

An investigation of the literature of the interdisciplinary areas that comment on technology in learning events reveals a number of theoretical frameworks of activities and technologies and technology selection methods that are not suitable for the design of technology-based learning events for a number of reasons. Some theoretical frameworks have been developed for purposes that are not related to technology-based learning events and others have been developed for learning events in which technology plays an adjunct role rather than a central one. The existing technology selection methods are either unsuitable, prescriptive or limited. Those that are unsuitable, like the theoretical frameworks, have been developed for use in learning events where technology only plays an adjunct role. Those that are limited include only technologies that were available at the time of their publication and hence will rapidly become out of date. Those that are prescriptive do not provide an insight into the nature and characteristics of the technology and hence restrict the designer’s ability to extend them to different uses.

1.3. Existing Conceptual Tools.
A number of different areas of academic study have presented theories of learning, learning activities, learning technologies and the process of matching technologies to learning as part of the design process. The areas include: Higher Education, Flexible Learning, Open Learning, Distance
Education, Instructional Design, Human Resource Development, Educational Technology, as well as the emerging fields of eLearning, Online Learning and others. The areas are not clearly differentiated and there are many examples of intersections and overlaps. For example in several places in the Instructional Design literature, commentators state that the market for the instruction they design is broad, including Higher Education and Human Resource Development. Yet each of these markets for the output of Instructional Design also has its own existing literature on learning technology. The Educational Technology field, that is concerned with the broad research of the application of technology to education, is not a discrete one and is reflected in the membership of organisations such as the Australasian Society for Computers in Learning in Higher Education (ASCILITE), which is comprised of teachers and researchers from Higher Education, Instructional Designers and Educational Technologists.

In the literature of Instructional Design and Higher Education, several conceptualisations of learning events can be found. However, these conceptualisations are not articulated into theoretical frameworks of learning events, which categorise activities in a way that is suitable for their matching to learning technologies, and hence cannot form technology selection methods. Some theoretical frameworks and methods for the selection of learning technologies have been put forward. Some methods consist of steps by which technologies are selected while others propose lists of factors to consider when selecting technologies. However, the
methods are not sophisticated, offering little in the way of conceptualisation and in each case the proposed method, model or list of factors for the selection of technologies is not appropriate for the current needs of facilitators designing learning events for Higher Education or Human Resource Development for a number of reasons. Some are prescriptive and while they may be applied successfully do little to provide the designer with an understanding of the limits and capabilities of the technology, and hence potentially preclude new applications. Others have been designed for use with technologies that were available when they were published and hence do not include or adapt to suit new technologies.

The field of Instructional Design, while small in Australia, has sufficient size in the USA and Europe to have a sturdy body of literature concerning the selection and use of learning technologies. In the literature of this field a systematic approach to the design of learning events is reported. The design process is usually based on one of several models in which the design of learning activities and the selection of learning technologies are steps. A comparison of the most popular models indicates that most contain elements that are similar if not equivalent.

“all descriptions include the core elements of analysis, design, development, implementation and evaluation (ADDIE) to ensure congruence among goals strategies and evaluation and the
effectiveness of the resulting instruction.” (Gustafson and Branch 2002, p 18)

In the design and development stages of models of instructional design attention is paid to the design and development of learning activities and to the selection of media or technologies. Three popular Instructional Design models, mentioned in the literature (Gagné 1992, Seels and Glasgow 1990, Gustafson and Branch 2002, Lin et al 1996), are those developed by Dick and Carey (Figure 1.1), Seels and Glasgow (Figure 1.2), and Kemp (Figure 1.3).

Figure 1.1. The Dick and Carey Instructional Design Model.

Figure 1.2. The Seels and Glasgow Instructional Design Model.
All three models contain steps in which the designer selects strategies or activities as well as a section in which learning technologies are selected. In the Dick and Carey Model (Figure 1.1) this is labelled “Develop and select instructional materials”, in the Seels and Glasgow Model (Figure 1.2), “Media Decisions” and in the Kemp Model (Figure 1.3), “Instructional Resources”. Clearly each of the models contains a section in which the designer considers what learning activities and learning technologies will be used.

While the field of Instructional Design provides well-conceptualised models of the design process that can be used by teachers and trainers in the design of learning events, the same cannot be said for the selection of technologies.
The technology selection methods in the literature of Instructional Design have been developed for use by Instructional Designers and it follows that to use them Instructional Design expertise is required. So they are not appropriate for facilitators outside of the Instructional Design field due to the high degree of knowledge and expertise assumed.

The literature of Instructional Design, Human Resource Development and Higher Education contains a number of conceptualisations of learning that have enjoyed varying degrees of favour over time. As in the literature of Instructional Design, technology selection methods reported in the Higher Education literature can be categorised as either those designed to select technologies that are intended to be simply adjuncts to the learning process or those for selecting technologies that are central to the learning process. The reports of this latter group are germane to the purpose of this thesis, but as they contain many case studies and little theorisation or generalisation of the technology selection process these reports have limited value in the application of technology selection principles in general or the application of them to new or different learning events and so they have limited value for the purpose of this thesis.

In the absence of appropriate theoretical frameworks of learning technologies and learning activities, the design of learning events that make appropriate use of learning technologies as central elements of the learning process, is at best difficult, if not impossible for facilitators who do not have an education in Instructional Design.
1.4. **Author’s Background.**

The findings reported in this thesis have been produced in the context of the author’s work in a number of units of the University of Wollongong, Australia. Since 1984 the author has worked in the Centre for Teaching Development, the Centre for Staff Development, Academic Development Services and the Centre for Educational Development and Interactive Resources. In each of these units the author has conducted staff development with respect to the use of technology in education. In this staff development role the author has provided conceptual advice regarding specific technologies that has articulated into practical advice to teachers and researchers. During the 1990s, a rapid increase in the use of Information and Communications Technologies in learning occurred at many universities, colleges and organisations around the world. This was reflected at the University of Wollongong and created a large staff development need for theoretical frameworks that could inform the field and translate into models and methods, on which sound practice could be based. This was the stimulus for the commencement of the research reported in this thesis.

To conduct the research in a formal setting the author enrolled in the Information Technology section of University of Wollongong’s School of Information Technology and Computer Science (SITACS). In this school, students are encouraged to take an interdisciplinary approach, actively seeking out contrasts, synergies and disparities between the various applications of Information Technology. As stated earlier, several fields
comment on the area investigated by this thesis, including Flexible Learning, Open Learning, Distance Education, Instructional Design, Human Resource Development, Educational Technology, eLearning and Online Learning. The original frameworks and methods presented in this thesis have been developed for use by designers of learning in Higher Education and Human Resource Development who have not been trained in Instructional Design. The thesis is qualitative and takes a theoretical approach based on a survey of the literature and the practical experience of the author.

As mentioned earlier, since 1984 the author has been employed by the University of Wollongong in a number of positions, all of which relate to the roles of technology in learning. During the 1990s the author undertook many projects, relevant to this thesis that include:

- Training of University of Wollongong teaching staff in the use and operation of videoconference for learning. This was the first use of videoconference in learning at Wollongong.

- Produced a literature review of the use of “state-of-the-art” technologies in higher education for the National Board of Education Employment and Training. The Australian Government Printing Service published this as a small book.

- Designed and installed University of Wollongong’s television studio. The studio was used to record television material for the Professional and Graduate Education (PAGE) program which was broadcast nationally by Special Broadcasting Services (SBS). The
author provided instructional design for teachers developing material for broadcast.

- Introduced the first program of Staff Development for Flexible Learning at the University of Wollongong.
- Investigated the potential of the World Wide Web in learning and taught HTML (Hypertext Mark-up Language) to students in the School of Information and Communications Technology.

In the year 2000 the author formed a research team within the Centre for Educational Development and Interactive Resources (CEDIR) at the University of Wollongong to investigate future technologies for learning. At the time of writing the team has developed into a program of CEDIR and has been named Learning Online and Future Technologies (LOFT). LOFT’s current projects include investigations of: DVD, streaming, database driven websites, handheld computing and wireless networking.

During his twenty years at the University of Wollongong the author has had to address, in practice and in theory, issues in the broad field of technology in learning. In the roles mentioned above he has provided practical advice to staff and has conducted research on the use of technologies in learning and the author’s role was central to the introduction of Flexible Learning at the University of Wollongong in the 1990s. It was during this time that the author identified the gap that the theoretical frameworks and method developed in this thesis fill and examples of the use of these frameworks are provided in Appendix 1.
1.5. The Area of Investigation.

This thesis is not a re-conceptualization of the mechanisms through which learning takes place nor is it a work of learning theory or educational psychology. The work draws on the literature of several fields and the theoretical frameworks and method developed in this thesis serve two purposes. They provide new approaches for researchers in the field and practical tools for designers of learning events in Higher Education and Human Resource Development who have little or no expertise in Instructional Design for technology-based learning events.

There is a growing body of literature concerned with aspects of Flexible, Open or Distance Learning. Three fields that are the major commentators in this area are Instructional Design, Higher Education and Human Resource Development. Within the literature of Flexible Open and Distance Education, a smaller area can be defined that is concerned with the design of Flexible, Open and Distance Learning in Higher Education and Human Resource Development. Within this smaller field are the two overlapping areas of learning activities and learning technologies. Of course there are other areas of discourse within this same region, such as learning theories and educational psychology, but they are outside the scope of this thesis. This thesis is concerned with parts of the learning technologies area and parts of the learning activities area as well as part of the intersection between them in which the relationships between learning activities and learning technologies are investigated.
As the thesis draws on an interdisciplinary range of literature and as each of these fields uses its own specific terms, this thesis uses some general terms to describe aspects that are common to all three areas.

1.6. Terms.

Further to the broad definition of learning as the acquisition of knowledge, skills and attitudes, the literature of Human Resource Development uses “learning” as an umbrella term to include training, development and education, where training is learning that pertains to the job, development is learning for the growth of the individual that is not related to a specific job and education is learning to prepare the individual but not related to a specific job (Wilson 1999) (see Figure 1.4).

In the thesis the term “learning” is used in the same way to describe training, development and education as intentional, structured learning in its broadest sense. As well the term “learner” is used to describe the
person learning, rather than terms such as “trainee” and “student”. As mentioned earlier, the term “facilitator” or “facilitator of learning” is used to describe the person who has prime responsibility for the facilitation of the learning rather than terms such as “teacher”, “trainer” or “developer”. Further, the term “learning event” is used to describe sessions of structured learning such as classes, subjects, courses and training programs.

The terms, “Open Learning”, “Flexible Learning” and “Distance Learning” are often used collectively as a compromise that adequately describes, very broadly, the approaches to learning that minimise the time that facilitators of learning need to spend in direct classroom contact with learners. In the thesis the term “Flexible Learning” is used in a broad sense to describe these approaches.

Within learning events, as defined above, are learning activities. These are defined for this thesis as the things learners and facilitators do that are intended to bring about the desired learning outcomes. Outside of face-to-face, classroom learning, learning activities are difficult to quantify and although many commentators have discussed learning activities there appears to be no consistent approach to their scale. For this thesis learning activities are defined, in the absence of a chronological scale, as the things learners and facilitators do that are intended to lead to the desired learning outcomes.
This thesis considers technologies that are used in the process of learning to provide material to learners, to allow interaction with material or to host dialogues between learners and between learners and facilitators. Prior to the advent of the Internet and the widespread use of Information and Communications Technologies, facilitators of learning referred to “media” which generally meant:

- printed matter (text and graphics),
- audio recordings,
- video recordings, films, or
- television and radio.

A broad definition of the term “instructional media” was put forward in 1983 and included all physical means by which instruction was delivered to students (Reiser and Gagné 1983). This definition included the person facilitating learning as well as the other standard classroom tools such as blackboards, textbooks and overhead projectors. Videoconference, radio and television broadcasts, the Internet and the World Wide Web can hardly be considered media as they are complex systems of technology that consist of hardware, software, networks and infrastructure. In several places there appears to be some confusion between the terms “media” and “technology”. Reiser (2002) suggests that the terms have evolved.

“By the early 1970s, the terms educational technology and instructional technology began to replace audiovisual instruction as
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the terms used to describe the application of **media** [my emphasis] for instructional purposes. (Reiser 2002, p 33)

Today, designers of learning events in educational institutions, or in business, industry, military, services or instrumentalities, can choose from a range of media that may include things such as videotapes, DVDs and audio recordings. They may also select from a range of technologies that can include such things as videoconference, email, and the World Wide Web. For the purposes of this thesis the salient difference between the definitions of a medium and a technology is degree of systemisation and the terms “medium” and “technology” are differentiated by the degree of the system involved. For example a videotape program is can be defined as a medium. However, the production, distribution and replaying of the video requires a system or systems of technology. The distinction is important as it reflects different levels of investment in equipment, personnel and infrastructure to produce and replay the medium. While the difference between the definitions of a medium and a technology might not be always completely clear, designers of learning make decisions to use both of them in learning.

Today the term “learning technology”, has displaced to a large degree, “educational technology”, “instructional technology” and others. The use of “media” has almost disappeared from the vernacular of those who design learning, which may well be a reflection of the obvious
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The technological nature of the Internet which is fast becoming, if not the most prolific learning technology, the one that can bring the most change.

The term “learning technology” is used in this thesis to describe technologies that are used in the process of learning to provide material to learners, to allow learners to interact with it, and/or to host dialogues between learners and between learners and facilitators. The term “medium” is used only where it refers to the material encapsulated rather than the technological system. For convenience a glossary of these terms is provided in the front matter.

1.7. New Conceptual Tools.

The conceptual gap in the literature or the lack of appropriate theoretical frameworks of learning activities, learning technologies and practical methods of technology selection is filled, by the research reported in this thesis, through the development of original, theoretical frameworks of learning activities and learning technologies that lead to the selection of appropriate learning technologies. The thesis also provides an original, practical method for the selection of learning technologies. The original theoretical frameworks and method are simple enough to be used by learning designers in Human Resource Development and Higher Education who have no formal education in Instructional Design and yet they are robust enough to be used in a wide range of disciplines in Higher Education and Human Resource Development for the design of learning events that are appropriate to the learners, the material, the context and
the budget. The new theoretical frameworks and the new technology selection method have been successfully used in several applications and reports of their testing are provided in Appendix 1.


The introduction, Chapter One, is followed by an investigation of the existing literature on technology and learning and as mentioned earlier there are a number of related and overlapping fields that report research in this area. The second half of the thesis develops and exemplifies the author’s original theoretical frameworks and method.

Chapter Two, reports on the roles of learning technologies and learning activities in Higher Education and Human Resource Development. An overview of the recent history of technology in learning provides a background to the literature review and a framework within which technological developments are categorised into generations (Nipper 1989, Taylor 2002). As well a brief summary of the history of technology in Higher Education, Human Resource Development and Instructional Design provides the context for the thesis.

The ways in which learning technologies have been classified and categorised in the literature of the overlapping fields of Higher Education, Human Resource Development and Instructional Design are reviewed. The role of learning technologies has changed over the past decade as they have been given a more central role with many subjects and
programs now either fully online or having an online component. The literature suggests a number of reasons for this changed role and describes them as benefits to learners and/or the organisation that flow from flexibility of where and when learners learn. Benefits from the adoption of flexible learning include increased participation rates in Higher Education and increases in efficiency through the timing of training that suits the organisation, the trainee and the task.

“Flexible learning increases opportunities for access to groups who were previously unable to participate in higher education for reasons including geographic location and occupation.” (Taylor and Joughin 1997, p 6)

In Higher Education the term “flexible learning” has been coined to describe this change in the process of learning and while definitions of flexible learning do not always mention them, learning technologies are usually the means through which flexibility is added to the process of learning.

As well as impacting on the process of learning, the change to Online Learning or eLearning impacts on the design of learning events as it includes learning technologies in new and different roles. This is reflected in changes to the ways in which the learning, learning technologies and their selection are conceptualised and theorised by researchers and learning designers.
As organisations operate in an information economy, learning needs change.

“The exponential growth of information that characterises modern business makes the need for learning more important than ever.”
(Rosenberg 2001, p 3)

The benefits of Online Learning or eLearning to Human Resource Development take on a financial value when flexibility of time and place of learning, in an organisation means that travel to a learning venue is reduced or eliminated and that learning can be scheduled at times that suit the organisation and the learner’s workload. In many cases technology plays a central role in the process of flexible learning and this changed role of learning technologies is reflected in changes to the way designers and facilitators of learning conceptualise and theorise about the learning, learning technologies and their selection.

The literature of the same overlapping fields is reviewed to ascertain conceptualisations of learning activities that can be used in the technology selection process. Learning activities have been conceptualised for several purposes but the tacit conceptualisations that occur as unintended by-products of the conceptualisations of learning technologies have most to offer to the selection of learning technologies. Some of the conceptualisations were found in the field of Instructional Design and its contribution to the theorisation of learning activities and learning
technologies is investigated. The field has two discrete markets, namely education and Human Resource Development and the literature includes a number of models of the learning event design process. Most of these models possess similarities that include sections or steps in the design process where learning activities and learning technologies are selected.

In Chapter Three the existing methods of selecting learning technologies are evaluated. Methods were sought that lead to the design of learning events that use learning technologies in ways that are appropriate to the learners, the material, the context and the budget. Two levels of technology selection are identified, the strategic and the tactical. Strategic decisions generally concern the acquisition of high-cost technological systems such as videoconference or Learning Management Systems and are typically made at the executive level of the organisation or institution. Tactical decisions concern the application of learning technologies, or technological elements of a Learning Management System to learning activities and these decisions are typically made by the designer of the learning event. Methods for the selection of learning technologies are evaluated for their applicability to the design of flexible learning in which technology has a central role.

Reports in the literature of the changing role of technology in the allied area of Organisational Communications are also investigated in this chapter. Much has been written about the selection of technologies for Organisational Communications as it is relevant and significant to
organisations as the reduction in ambiguity in communications within an organisation can improve efficiency. An investigation of this literature indicates that this highly theorised area has not only theories but families of theories, of technology selection that have changed with the changing capabilities and characteristics of technology and the different communications needs of organisations. The trait family of theories provides a theoretical framework of technologies and categorises them according to their traits. Theories in the family include Media Richness Theory and Social Presence Theory. Later theories extend trait theories to include other attributes or benefits that impact on the selection process and yet others view the selection of technology as a social process. While these theories are important to the efficiency of communications within organisations and have limitations as approaches to the selection of technology for learning, they do provide a partial theoretical framework within which technologies may be analysed.

Chapter Four, summarises the findings of the reviews of the literature in Chapters Two and Three and reports on the ways in which the related and overlapping fields of Higher Education, Human Resource Development and Instructional Design have tried to match learning technologies to the activities of the learning process. It reports that some attempts to do this have failed due to the absence of a clear theoretical framework for the analysis of the activities of the learning process and of learning technologies. Other attempts have been successful but are not suited to the changed role of technology in learning or require specialist
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Instructional Designeds for their use. This chapter also draws from the literature a key element that a number of commentators are in agreement about: that technologies can be overtly or tacitly classified as those that are one-way or representational and those that are two-way or dialogic. The shortcomings of existing theoretical frameworks of learning activities and learning technologies are summarised, the gap in the literature is described, and the solutions developed in this thesis are signalled.

The second part of the thesis contains the original theoretical frameworks and the original practical method. Chapter Five introduces a theoretical framework of the activities of the process of learning, entitled the Learning Activities Model (LAM). In many places the literature describes learning activities as consisting of interactions and delivered materials but previous investigators have chosen not to use these categories of learning activities as overt tools for the analysis of the learning process. The research reported here further conceptualises the activities of learning and presents the Learning Activities Model in which learning activities are categorised as the provision of material and interactions. Interactions are divided into the categories of interactions with materials, interactions with other humans and a last category, entitled by the author as “Intra-action” which includes the activities not in the other categories. The Learning Activities Model is a new theoretical framework with theoretical and practical uses. One of the practical uses is in the selection of learning technologies and is detailed in the Technology Selection Method in Chapter Seven. Examples
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of the use of the Learning Activities Model in the field are provided in Appendix One.

Chapter Six introduces an original theoretical framework of learning technologies. The framework, entitled the Learning Technologies Model (LTM), draws on the literature of learning technology in several related and overlapping fields and the field of Organisational Communications. A key element from the literature is the description of learning technologies as one-way or two-way. One of the theoretical approaches to technology selection in the Organisational Communication literature classifies communications technologies by their traits or “richness”. The Learning Technologies Model (LTM) is based on the juxtaposition of the two dimensions of:

- one-way or two-way, and
- richness.

These two dimensions form the basis of a new theoretical approach to the analysis and categorisation of learning technologies. The Learning Technologies Model is then extended to consider two further characteristics of learning technologies. These are:

- the categories of the Learning Activities Model that are supported by individual technologies, and
- whether the technology supports synchronous or asynchronous communications.
A selection of learning technologies is then analysed by the Learning Technologies Model.

In Chapter Seven the Learning Activities Model and the Learning Technologies Model are brought together to form an original practical method for the selection of learning technologies that can be used in the design of learning events. The Technology Selection Method uses the two theoretical frameworks to match learning technologies to categories of learning activities and, through a four-step process, provides a practical method of technology selection that is simple enough to be used by trainers and teachers who are not Instructional Design specialists and yet robust enough to be used in many disciplines in both the Higher Education and Human Resource Development contexts.

There is ample evidence that a technology selection method is required for the growing number of designers of learning in the areas of Higher education and Human Resource Development who are not skilled in Instructional Design. Facilitators of learning require technology selection methods that provide an insight into the technologies they select rather than methods that prescribe fixed technological solutions to general design needs. As well, as learning technologies, or technological elements of Learning Management Systems are not generally applied to complete subjects or programs, teachers and trainers require a framework within which they can conceptualise learning activities in ways that are suitable for the application of individual technologies. The literature has been
reviewed and the conceptualisations of learning activities and learning
technologies as well as the technology selection methods located are not
suited to the purpose of this thesis. In this thesis two original theoretical
frameworks and a method are presented which fill the gap in the selection
of technologies for flexible learning. The Learning Activities Model (LAM)
is a new theoretical framework of learning activities, the Learning
Technologies Model (LTM) is a new theoretical framework of learning
technologies and the Technology Selection Method (TSM) matches
technologies as described by the LTM to learning activities as described
by the LAM. The Technology Selection Method (TSM) is simple enough to
be used by learning designers with no training in Instructional Design yet
robust enough to be used in a wide range of disciplines in the areas of
Human Resource Development and Higher Education.
Chapter 2

Existing Theories of Learning Technologies and Learning Activities.

2.1. Introduction.

“For over 3000 years from Homer, Moses and Socrates onwards, the teacher in direct, personal contact with the learner, has been the primary means of communicating knowledge…until the fourteenth century, when the invention of the printing press allowed for the first time the large-scale dissemination of knowledge though books.” (Bates 1995, p 28)

Today there is a range of technologies available to those who design learning events, from the old and simple to the new and complex. Key attempts have been made to develop theoretical frameworks of learning technologies and are reported in the literature of the fields of Higher Education, Human Resource Development and Instructional Design. As mentioned in Chapter One these three fields are not discrete and some overlap occurs. For example commentators in the field of Instructional Design state that their designs are intended for learning in many contexts
including schools, higher education, organisations and government
(Gagné et al 1995, Reigeluth 1983). In many cases the theoretical
frameworks are intended to guide the selection of learning technologies
but often the conceptualisations have not always kept pace with
technological change. The literature of these fields will be reviewed to
evaluate the suitability of conceptualisations of learning technologies to
their selection in the process of designing learning events.

Learning technologies are generally not applied to a whole subject or
program, rather they are applied to elements or groups of activities within
a subject or program and a conceptualisation of these groups of learning
activities to which learning technologies can be matched would form the
basis of a sound technology selection method. The literature of the fields
mentioned above is reviewed to ascertain the suitability of conceptions of
learning activities to this purpose. Before the literature is reviewed a brief
historical background of learning technologies is provided as a context and
background to the changes in learning technologies, their role in learning
and the ways in which they have been conceptualised.

2.2. Recent History of Technology in Learning.

Technological developments in the past fifty years have had a marked
impact on the lifestyles of most people in industrialised countries and a
growing number of developing countries. In Australia the technologies of
television and telephony became more or less ubiquitous by 1970. In this
time the role of technology in learning changed as well. In the 1960s and
1970s teachers in schools and universities as well as trainers in
commercial, industrial and government organisations had opportunities to include technological “teaching aids” such as overhead projectors, filmstrips, movies, radio and television broadcasts in the learning events they designed. In the 1960s large computers could be found at many Australian universities but it was not until the advent of the personal computer in the 1980s that computers made an impact on teaching and learning in a majority of subject areas. In the late 1980s and early 1990s, the development of the Internet and its combination with personal computers could be argued as producing the most significant change, especially in the Higher Education and Human Resource Development contexts, to the way technology is used in learning. In Distance Education, technology has always played a more central role than in classroom, or face-to-face, teaching and learning. Due to the “separation of teacher and student” (Keegan 1986, p 43), technology has often been used to mediate communications between teachers and students and for the encapsulation of materials. When mainstream Higher Education and Human Resource Management started to use technology to mediate learning, it was to the literature of Distance Education designers and managers turned to seek theoretical or conceptual frameworks. They sought frameworks that would allow them to generalise the techniques and technological approaches of Distance Education to their own contexts.

In the Distance Education literature, the changing technologies and their roles have been charted and divided into generations that clearly differentiate between the technologies used. As mentioned earlier,
technology has always played a central role in Distance Education and it is obvious that transitional stages in Distance Education are clearly linked to the uptake of new technologies. There are limited historical interpretations of Distance Education in the literature, and the work of Nipper (1989) and Taylor (2001) stands out as a framework that provides an evolutionary description of technological changes in this field. As well the work of Taylor (2001), in the development of a conceptual framework of the generations of Distance Education, provides part of the conceptual basis for the theoretical frameworks that are developed in the second part of this thesis.

2.2.1. History of Learning Technology in Higher Education.

In 1989 Søren Nipper classified distance education into three “generations” which provided a succinct start to the historical description of technology in Distance Education. This classification is sufficiently broad to provide a relevant framework for an historical overview of the changed role of technology in learning in other contexts and has been extended by Taylor (2001) to include development of Flexible Learning. Nipper describes the first generation of Distance Education as consisting of correspondence courses based on printed matter delivered by the postal service. He describes the second generation as comprising multi-media packages and the third as a combination of broadcast media and teleconferences. In the second and third generations a mixture of technologies was used. Examples of typical mixes of technology were, print and video in the second generation and print and videoconference in
the third. However, it is not until the third generation that the separation
between technologies used for the provision of materials and others for
interactions between people is made. The changes in learning
technologies as described by the generations of Distance Education are
reflected in changes in the use of learning technologies in Instructional
Similar stages of development can also be found in the Human Resource
Development literature with the adoption of Open, Distance and Flexible
Learning techniques and technologies to provide some flexibility of the
place and time of learning (Wilson 1999).

Taylor (1997, 2001) continues and extends Nipper’s work to include
Fourth and Fifth Generations of Distance Education in which the boundary
between Distance Education and mainstream Higher Education and
Human Resource Management becomes blurred (see Table 2.1). The
boundary becomes blurred as Flexible Learning is used in mainstream
Higher Education and utilizes technologies and techniques that in earlier
generations were confined to Distance Education. Taylor’s Fourth
Generation, entitled “The Flexible Learning Model” not only reinforces the
connection between Distance Education and Flexible Learning but
suggests that Flexible Learning has evolved logically from Distance
Education as it takes the flexibility of time, place and pace offered by
Distance Education techniques and technologies and applies then to
mainstream Higher Education and to Human Resource Development. In
the Fifth Generation Taylor suggests that the use of technology has been
extended into institutional processes and that they as well as learning are predominantly online. Table 2.1, reproduced from Taylor (2001), provides a description of the generations.

<table>
<thead>
<tr>
<th>Models of Distance Education</th>
<th>Associated Delivery Technologies</th>
<th>Characteristics of Delivery Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Flexibility</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time</td>
</tr>
<tr>
<td>First Generation – The Correspondence Model</td>
<td>• Print</td>
<td>Yes</td>
</tr>
<tr>
<td>Second Generation – The Multi-Media Model</td>
<td>• Print • Audiotape • Videotape • Computer-based learning (eg CML/CAL) • Interactive video (disk and tape)</td>
<td>Yes</td>
</tr>
<tr>
<td>Third Generation - The Telelearning Model</td>
<td>• Audio-teleconference • Videoconference • Audioraphic Communication • Broadcast TV/Radio, Audioteleconference</td>
<td>No</td>
</tr>
<tr>
<td>Fourth Generation – The Flexible Learning Model</td>
<td>• Interactive multimedia • internet based access to www resources • computer mediated communications</td>
<td>Yes</td>
</tr>
<tr>
<td>Fifth Generation – The Intelligent Flexible Learning Model</td>
<td>• interactive multimedia online • internet based access to WWW resources • Computer-mediated communication, using automated response systems • Campus portal access to institutional processes and resources</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 2.1. Reproduced from Taylor (2001), provides a description of the generations.
Taylor’s framework (Table 2.1) indicates that a salient characteristic of the technologies of Distance Education and Flexible Learning is the differentiation between materials and interactivity which is an important first step in the categorisation of learning technologies. The two right hand columns in Table 2.1 indicate that each generation and technology mentioned includes some level of materials provided to learners and/or interactivity.

In the First Generation the technology was predominantly printed material and while Taylor’s framework indicates that there was no “Advanced Interactive Delivery” some limited interaction could be had through the comments of the assessor on the work of the learner. Of course, as the technology was limited to printed material, its role in this generation of Distance Education was both to provide materials to learners and to facilitate limited feedback from assessors. As well, and obviously as the generation is characterised by one technology, selection of technologies was not required.

In the Second Generation of Distance Education, use was made of several technologies such as video and audiotapes, as well as early computer-based learning. In this generation, designers of learning events were faced with an additional task, that of selecting technology and in many cases would have engaged specialist Instructional Designers who
selected the technologies as part of the design of the learning events. The available technologies from which selections were made were predominantly one-way as they were for the provision of materials hence interaction between learners and between learners and facilitators of learning was limited.

Taylor’s framework, (Table 2.1), can be interpreted as implying that the technologies of an earlier generation are not used in later ones. However, it is generally known that technologies of previous generations were typically available and used in subsequent ones. For example while printed materials are only mentioned in the First and Second Generations, obviously they have been used, to varying degrees, in all generations to date. The technologies listed for each generation represent a change in focus and the new technologies that were introduced in each generation. So designers in the Third Generation could design learning events, selecting from the innovative, two-way technologies of the Third Generation, which provided increased interaction between the people involved, and the more familiar, one-way technologies of the earlier generations.

The Fourth Generation marks a watershed in the application of the techniques and technologies of Distance Education. In the 1980s and 1990s many institutions actively borrowed approaches that hitherto were practiced only by Distance Education and Open Learning institutions and applied them in various degrees to what were traditionally face-to-face
learning events. Although it is beyond the scope of this thesis to theorise about the reasons for this change, it is generally known that the increase in demand for flexibility of place and time of learning came about for two reasons. One was to meet the demand of an increasingly employed and hence part-time student body and the other was in the pursuit of the efficiencies of increased student to staff ratios that Distance Education techniques appeared to offer. This new approach to teaching had many names and in the 1990s “Flexible Delivery” or “Flexible Learning” entered the popular parlance of Higher Education in Australia.

“In many contexts, including continuing professional education, the clientele for distance education consists largely of part-time students in full-time employment, thus distance educators have had to provide teaching-learning resources (printed study guides, audiotapes, videotapes, computer-based courseware, etc) of high quality that could be used at a time and in a place convenient to each student. In effect, these "flexible access" technologies (Taylor, 1992) allow the student to turn the teacher on, or off, at will as lifestyle permits. Similarly, access to the Internet facilitates interactivity, without sacrificing the benefits of flexibility, since it can be used to support asynchronous communication.” (Taylor 1996, p 2)

For mainstream Higher Education this represented marked changes in the process of learning, which of course necessitated changes in the design of
learning events. Designers who had previously designed for the
classroom, where technologies were used as adjuncts to the learning
process, were now faced with designing for technologies that played a
central role in the learning process, and in many cases designers did so
with the support of guidelines and checklists developed by institutions in
attempts to facilitate and conceptualise learning in this context of changing
technology. The salient difference was that where technologies were
previously selected to be adjuncts to learning events they were now being
selected to play central roles, of facilitating or mediating learning events.
During this generation the World Wide Web was accepted by many
institutions as a central and systemic learning technology. Web learning
environments or Learning Management Systems (LMS), such as
Blackboard and WebCT, have enjoyed rapid and wide acceptance in
Higher Education. Describing itself as “the world's leading provider of e-
Learning solutions for Higher Education” (WebCT 2001), WebCT claims
that over 2,600 institutions in 84 countries are licensed to use its learning
environment (WebCT 2001a). This widespread use of web-based learning
environments has engendered new terms in the parlance of Higher
Education and web-based learning is often referred to as “Online
Learning” or “eLearning”.

The Fifth Generation as described by Taylor builds on the Fourth with the
addition of “campus portal access to institutional processes and
resources” and “automated response systems”. Portals provide students
with an efficient access point to learning materials and resources as well
as records of their progress and host communications with the administrative and support units of the institution. However, they do not impact to any great degree on the selection of technology at the tactical level. Therefore, for the purpose of this thesis there is not a significant difference between the Fourth and Fifth Generations.

At the time of writing many organisations and institutions have a degree of online learning. In some cases learners may do all their learning online, in others the online elements serve to support to the face-to-face experience. The resources to assist designers of online learning are limited and many organisations and institutions do not have sufficient specialist learning event designers to design of all the online learning events they offer. As most learning event design in Higher Education is undertaken by facilitators there is a need for guidelines to assist them in this process. Such guidelines necessarily would include a method for the selection of technologies that leads to applications of learning technologies that are appropriate to the learners, the material, the context and the budget.

The generations of Distance Education as described by Nipper (1989) and expanded into a framework by Taylor (2001) provide an evolutionary description of technological change in Distance Education and in the later generations describe the changed role of technology in Higher Education. However, these technological changes are not confined to these fields. In the field of Human Resource Development, parallel, but sometimes
delayed changes in the utilization of learning technologies permits the application of Taylor’s conceptual framework to it.

2.2.2. History of Technology in Human Resource Development.

The changing role of learning technology in Higher Education is reflected in Human Resource Development. Training in organisations has been happening for a long time and the master/apprentice model has been used for thousands of years. While it can be argued that this model has stood the test of time it is no longer considered appropriate to meet all the learning needs of organisations and other methods of providing training to employees have increased in the post World War Two period (Smith 1992). During the twentieth century, with the development of the discipline of psychology to include learning theories and the development of economic theories that provided a link between training and profitability, other models of learning within organisations were developed. After the Second World War, and perhaps as a reaction to the need for highly efficient training and retraining needs, the term “Human Resources” entered the parlance of management and in 1968 was extended to “Human Resources Development” by Leonard Nadler (Sredl and Rothwell 1986). Since then the study and practice of Human Resource Development has grown into a discipline with a sturdy discourse.

As mentioned in Chapter One, Human Resource Development has differentiated learning into three modes: training, education and development. Where training refers to learning that applies to the current
task in the organisation, education is learning in educational institutions and development is learning for growth of the individual but not necessarily directly related to the current task (Wilson 1999).

The approaches taken by Human Resource Development to learning within organisations have been driven in large part by the potential to improve job performance and hence increase profitability (Nadler and Nadler 1990).

“For organisations, the importance of training lies in its links to performance and competitiveness … there is little doubt that training is a key ingredient in competitive success.” (Smith 1992, p 4)

Organisations are generally quick to adopt new training methods if they are more efficient than the status quo (Commission on Technology and Adult Learning, 2001 p10). For example the increase in the use of videoconference in Australia in the early 1990s, while driven initially by an airline pilots’ strike, did not decrease to pre-strike levels after the pilots went back to work. It is generally known that, as organisations counted the savings in travel time and expenses, videoconference was retained as a more cost effective learning technology. A similar increase in the use of videoconference occurred immediately after the September 11 terrorist attacks on the World Trade Centre. At the time of writing the threat of death or illness due to SARS (Severe Acute Respiratory Syndrome) has caused managements of organisations to curtail employees travel to those regions affected. In many of these cases learning technologies are being
used to remotely provide learning events. The University of Wollongong, which has teaching commitments in the SARS affected regions of Singapore, Hong Kong and China, is currently providing learning materials to learners through audio and video recording and Internet streaming as an alternate way to meet its commitments.

Traditional classroom technologies such as overhead projectors, slides, movies, video and audio recordings have been used in training at much the same time as they were used in Higher Education. However the training needs of organisations have different levels of scale, and are more disparate than the educational needs of students in Higher Education. While this, and possibly the required investment in infrastructure, has resulted in a slower rate of uptake of organisation-wide Flexible Learning, some organisations are actively investigating and deploying learning technologies that play a central in the training process. Many terms have been coined to describe these approaches, including: Technology Based Training (TBT), Web Based Training (WBT), Internet Based Training (IBT) and eLearning to name a few. In the development of these newer uses of technology in learning, Human Resource Developers have drawn heavily on the discourse of Open, Distance and Flexible Learning (ODFL) (Wilson 1999) and the technologies used are the same as those described by Taylor in the Fourth and Fifth Generations of Models of Distance Education: A Conceptual Framework (Table 2.1).
Flexible approaches to training have benefits and costs to organisations.
The benefits from flexibility of when training occurs mean that trainees can learn when it suits the task or the organisation. For organisations that have branches or are geographically dispersed the benefits include a reduction or the removal of travel time and expenses between the trainee’s workplace and the training venue. The costs of flexible approaches to learning arise from the resources and infrastructure required to provide it. These can range from the production costs of printed materials, videotapes or web pages to the costs to set up in-house, or hire external, videoconference or media production facilities. Of course a relationship exists between the amount spent on the learning event, the number of trainees that can be trained with it and the increase in profitability that will result. For example investment levels in a learning resource with a long shelf-life that can be reused many times can generally afford to be higher than those for resources that are subject to rapid change.

2.2.3. History of Technology in Instructional Design.
The process of Instructional Design is concerned with the planning, design, development, implementation and evaluation of instructional activities or events that facilitate learning and the purpose of the discipline of Instructional Design is to build knowledge about the steps for the development of instruction (Seels and Glasgow 1990). While the history of Instructional Design is relatively young compared with Higher Education there are parallels in each that concern the use of learning technologies. The most recent of which is also evident in Human Resource
Chapter 2. Existing Theories of Learning Technologies and Learning Activities.

Development and concerns the use of technology as central elements of the learning process.

There is some confusion in the literature as to the origins of Instructional Design. It has been suggested that it started at the turn of the twentieth century.

“In his presidential address to the American Psychological Association in 1899, John Dewey called for the development of a linking science between learning theory and educational practice.” (Reigeluth 1983, p 5)

However other commentators state that the field grew out of the special training needs of World War Two and the solutions to them that were designed by educators and psychologists (Reiser and Dempsey 2002). During the second half of the twentieth century Instructional Design grew to be recognised as a discipline with its own literature.

The field of Instructional Design does not limit its output to one area. In many instances the field is described as designing instruction for schools, higher education, technical education, business, industry, the military, health care and others (Reiser and Dempsey 2002, Gagné et al 1992, Reigeluth 1983).

In many ways the history of the use of technology in Instructional Design reflects the patterns noted in Higher Education and Human Resource
Chapter 2. Existing Theories of Learning Technologies and Learning Activities.

Development. Apart from the practice of Distance Education, technology in Instructional Design during the 1950s and 1960s was confined primarily to classroom technologies such as movies, slides, audio recordings and printed resources, where their use was confined to adjuncts to teaching activities. This was also the general use that learning technologies were put to in Higher Education and Human Resource Development during the same period and is reflected in the term, “teaching aids” that was used to describe them. During the 1970s with the proliferation of mass media and affordable technologies of encapsulation, the term “teaching aids” was replaced with “instructional media” and “educational technology” and the role of the technology was increased to provide some level of individual instruction. This changed role of technology caused the field to change its conceptualisation of the role of technology and included in the process of Instructional Design was the new task of selecting technologies, often referred to as “media”, that would play a significant role in the learning event being designed.

The development and proliferation of personal computers in the late 1980s and 1990s, together with the Internet and the World Wide Web in the mid 1990s, created the opportunity for the next major change of direction in the use of technology in learning. This change was felt in Instructional Design and recent contributions to the discourse have reflected the heightened role of technology in learning to the extent that in one notable monograph (Reiser and Dempsey 2002) the field is renamed “Instructional Design and Technology”. The technologies used in this stage of the evolution of
Chapter 2. Existing Theories of Learning Technologies and Learning Activities.

Instructional Design are the same as those described by Taylor in the Fourth and Fifth Generations of Models of Distance Education: A Conceptual Framework (Table 2.1).

While the Fields of Higher Education, Human Resource Development and Instructional Design all have slightly different approaches to, and uses of, learning technologies there are parallel trends in each field that reflect the Fourth and Fifth Generations of Distance Education (Taylor 2001). While each field might use the same learning technologies in slightly different ways, Taylor’s classification, in the Model of Distance Education (Table 2.1), in which they are categorised as providing “Highly Refined Materials” or facilitating “Advanced Interactive Delivery” is sufficiently broad to apply to each field and to provide a rudimentary conceptual differentiation of learning technologies in general.

A review of the literature of the fields of Higher Education, Human Resource Development and Instructional Design to evaluate the suitability of conceptualisations of learning technologies to technology selection reveals that as learning technologies and their use have changed, different theoretical approaches to their conceptualisation have been reported. In many cases the aim has been assisting in the design of learning events that make use of learning technologies in appropriate ways.

2.3. Categorisation and Classification of Learning Technologies.
In many instances attempts have been made to categorise and/or classify learning technologies. In the literature of several fields (for example: Instructional Design, Higher Education, Human Resource Development) attempts have been made to classify learning technologies by the inherent characteristics of the technology or categorise them by the role they play in learning. As the number of technologies that are available to learning designers has grown rapidly, many of the attempts to categorise them have dated and others appear perfunctory in the context of newer technologies.

Leshin, Pollock and Reigeluth (1992) present a classification scheme for “media” that is based on attributes in which learning technologies are grouped into five “systems”.

- human based system (teacher instructor, tutor, role-plays, group activities, field trips)
- print-based system (books, manuals, workbooks, job aids and handouts)
- visual-based system (books, job aids, charts, graphs, maps, figures, transparencies, slides)
- audiovisual-based system (video, film, slide-tape programs, live television) or
- computer-based system (computer-based instruction, computer-based interactive video, hypertext).” (Leshin et al 1992, p 256)
They state that the “systems” share the characteristic of carrying “a message (information) to a receiver (learner)” and that some “systems” can “process messages from the receiver” (Leshin et al 1992, p 256). Writing in the field of Instructional Design, Leshin, Pollock and Reigeluth use their classification as a starting point from which technology-based learning events can be designed.

“No through the process of message design you will tailor your instruction to a particular medium or set of media.” (Leshin et al 1992, p 256)

The approach taken to the classification of learning technologies by Leshin, Pollock and Reigeluth is not suitable for the purpose of this thesis. The classification system provides little or no insight into the application of the technology, is not much more than a labelling system and, as they were writing prior to the development of the World Wide Web, the classification system does not include Learning Management Systems. They could easily be added to the last category: Computer-based systems, but this adds little to our understanding of them or to their application to learning in an appropriate way.

Also writing in the literature of Instructional Design, Romiszowski (1988) classifies “media” by the sensory channels they support and provides examples such as telephone for the auditory channel, video for the “Audio/Visual” channel, chalkboards for the visual channel and devices or
models for the “Tactile or Kinaesthetic” channel. Romiszowski’s approach is slightly more informative than that of Leshin, Pollock and Reigeluth as he makes the conceptual connection between technologies and “sensory channels”. However his system of classification is not suited to the purpose of this thesis for the same reason as Leshin, Pollock and Reigeluth’s, that is, it provides little insight into the characteristics of the technologies which lead to the matching of them to learning activities in an appropriate manner.

Others in the field of Instructional Design take an even less rigorous approach to the categorisation or classification of learning technologies. Reiser and Gagné (1983) argue that a “number of kinds of categories can be devised for the classification of media” and that “frequently employed categories include audio, print, still visual and motion visual, and real objects” (Reiser and Gagné 1983, p 13). They elaborate that the reasons for categorising “media” are generally associated with their selection and that their application can be optimised through matching their characteristics to the task.

“… a particular type of medium can best present a task having a similar classification. For example the learning of a task that requires differentiation of visual features can best be done with a visual medium.” (Reiser and Gagné 1983, p 13)
While Reiser and Gagné’s categorisation of “media” is appropriate for the selection of technologies as adjuncts to classroom teaching from the technologies available in the early 1980s it does not have much to offer the selection of learning technologies as central elements of learning events and does not easily expand to address technologies developed after their conceptualisation was published.

Some other commentators have taken a more interpretive approach to the categorisation of learning technologies. Contrary to the descriptive classification approaches, Laurillard (2002) categorises learning technologies through the use of “pedagogical categories” and argues that:

“There are many attempts in the literature to categorise and classify the forms of media, none of which is very illuminating for our purpose here.” (Laurillard 2002, p 83)

Laurillard continues with the argument that “educational media” should be classified in terms of the categories and extent of learning processes they support and provides the four categories: “Discursive, Adaptive, Interactive and Reflective”. Laurillard’s categories provide limited insight to the nature and characteristics of learning technologies when used outside of her “teaching strategy” and hence are not suited to the purpose of this thesis. A further discussion of Laurillard’s categorisation for the purpose of technology selection is included in Chapter Three.
In a similar fashion to Leshin, Pollock and Reigeluth, Romiszowski and Reiser and Gagné, Bates classifies learning technologies in two ways. Firstly, according to the “medium they carry” and he states:

"In education the five most important media are:
- direct human contact (face-to-face)
- text (including still graphics)
- audio
- television
- computing" (Bates 1995, p 31)

Secondly, Bates distinguishes between technologies that are:

“primarily one-way and those that are primarily two-way, in that they allow for interpersonal communication.” (Bates 1995, p 32)

Bates, writing about Open Learning and Distance Education in Higher Education, where in the past communications between learners and between learners and facilitators have been difficult due to the absence or lack of face-to-face opportunities, describes one and two-way technologies for four of the “five most important media”. This correlation is shown in Table 2.2. The classification of learning technologies as being primarily one-way or two-way is reflected in Taylor’s Conceptual Framework (Table 2.1) in which he classifies characteristics of technologies as ‘Highly Refined Materials” and/or “Advanced Interactive Delivery”. Taylor (2001),
citing Bates, makes it clear that there are two very different types of interactivity: social interactivity and interaction with resources.

<table>
<thead>
<tr>
<th>Media</th>
<th>One-way technology applications</th>
<th>Two-way technology applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text</td>
<td>Course units; supplementary materials</td>
<td>Correspondence tutoring</td>
</tr>
<tr>
<td>Audio</td>
<td>Cassette programmes; radio programmes</td>
<td>Telephone tutoring; audio conferencing</td>
</tr>
<tr>
<td>Television</td>
<td>Broadcast programmes; cassette programmes</td>
<td>Interactive television (TV out; telephone in); video conferencing</td>
</tr>
<tr>
<td>Computing</td>
<td>CAL, CAI, CBT[*]; databases; multimedia</td>
<td>E-mail; interactive databases; computer conferencing</td>
</tr>
</tbody>
</table>

* Computer Aided Learning, Computer Aided Instruction, Computer Based Training

Table 2.2. One-Way and Two-Way Technology Applications in Distance Education (Bates 1995, p 31).

This can confuse the notion of two-way technologies and from Table 2.2, Bates’ examples, with the exception of “interactive databases” all are of human interactions between learners or between learners and facilitators of learning. In the Fourth and Fifth Generations of Distance Education as described by Taylor (Table 2.1) the technologies are characterised by both kinds of interactivity and unfortunately no differentiation between interactions between people and interactions with materials is provided. The congruency between Bates’ (1995) approach to the classification of learning technologies as one-way or two-way and Taylor’s approach, is supported by Rowntree (1994) who classifies learning technologies as:

- Print-Based,
- Audio-visual or technology-based
Chapter 2. Existing Theories of Learning Technologies and Learning Activities.

- Practical or project work, or
- Human Interaction
- others” (Rowntree 1994, p 66)

Clearly the first three categories are one-way for the provision of, and interaction with, materials and the last category is clearly for the two-way interactions between people.

The conceptualisation of learning technologies as one-way or two-way provides a starting point for a theoretical framework of learning technologies that categorises them according to the learning activities they support. This theoretical framework is developed further in the second part of this thesis.

From Table 2.1, it is clear that in all but the First Generation of Distance Education more than one technology is indicated and a combination of technologies is generally used within a subject or course. Learning Management Systems can be considered a single technological system and indeed they are packaged as such. However, for the purposes of the design of learning events that make appropriate use of them, Learning Management Systems can be considered to be collections of technological elements. Each technological element can have a separate role in the learning event such as the presentation of information, the facilitation of discussion or others. The selection of appropriate learning technologies can then be seen as the matching of single technologies, or
technological elements of Learning Management Systems, to sections of a subject or course or to categories of learning activities. The literature of Higher Education, Human Resource Development and Instructional Design is surveyed to ascertain the suitability of existing conceptualisations of learning activities to the process of technology selection.

2.4. Learning Activities.

The design of learning is probably more clearly described as the design of learning activities as it is the activities that are designable compared to “learning” which is the desired outcome of the activities. While the term “instruction” may be out of favour with some commentators, as it may imply a teacher-directed approach, “Instructional Design” has been used for some years to describe the design of the things learners and teachers or trainers do to facilitate learning.

"Instruction is a set of events that affect learners in such a way that learning is facilitated. Normally we think of events as external to the learner – events embodied in the display of printed pages or the talk of a teacher. However, we also must recognize that the events that make up instruction may be partly internal when they constitute the learner activity called self-instruction." (Gagné et al 1992, p 3)

One of the objectives of this thesis is to investigate the existing conceptualisations of learning activities in terms of their suitability for
technology selection by matching them to learning technologies. Courses of study, subjects or training programs are generally too large to be matched to a particular technology or technological element of a Learning Management System. As mentioned earlier, Distance Education courses are generally characterised by a “package” of several technologies (Bates 1995) or “combination of media” (Rowntree 1994) which indicates clearly that more than one technology is generally used. In Online Learning or eLearning where a Learning Management System (LMS) is matched to a course, subject or program the question remains of how to undertake the matching of each technological element of the LMS to subsections of the course, subject or program. This thesis considers approaches to the categorisation and classification of learning activities and seeks to reconceptualize them in such a way as to facilitate their matching to learning technologies. However, before conceptualisations are considered some clarification and a definition of learning activities is required.

Gagné, Briggs and Wager (1992) use the term “events of instruction” to describe decisions made by teachers during a class.

“The instructional events of a lesson may take a variety of forms. They may require the teacher’s participation to a greater or lesser degree, and they may be determined by the student to a greater or lesser degree. In a basic sense, these events constitute a set of communications to the student.” (Gagné et al 1992, p 186)
The scale of each of the “events” or learning activities is temporally smaller than a lesson or class as generally more than one would take place in a lesson or class. For the purpose of this thesis, that is to find or develop a conceptualisation of learning activities that is suitable for use in the selection of learning technologies, it is sufficient to define them as activities that are smaller than lessons or classes, where these are considered as timetabled meetings between learners and facilitators or the equivalent in the context of Flexible Learning. The literature of Instructional Design places the design of learning activities as a step in the design of a larger course, subject or curriculum.

With a small number of notable exceptions (Laurillard 2002, Gagné et al 1992) there is little reference in the literature to explicit methods of classification and categorisation of learning activities. However, several commentators provide tacit classification as a by-product of discussions for other purposes.

### 2.5. Theories of Learning Activities.

The approaches to the theorisation of Learning Activities can be grouped into four categories. Some commentators categorise or classify learning activities for purposes other than the selection of learning technologies. Others do not overtly categorise or classify yet provide tacit conceptualisations while achieving other ends and yet others simply list methods or examples of learning activities in the absence of a more detailed conceptual framework. A fourth approach is to provide categories
of learning activities that may ultimately assist in the selection of learning technologies in a way that is appropriate for the learners, the material, the context and the budget.

2.5.1. Theories of Learning Activities for Purposes Other than the Selection of Learning Technologies.

Theories of learning activities for other purposes may appear to be a digression. However, a short discussion of them adds to this thesis through the provision of the background to the theoretical approaches taken hitherto as well as providing an insight to the temporal and other physical qualities of learning activities.

The approach taken by Gagné, Briggs and Wager (1992) and cited by numerous other commentators (Laurillard 2002, Smith and Ragan 1993, Seels and Glasgow 1990) is to classify learning events in terms of their purpose and nature and then categorise them in terms of their chronological appearance in a lesson.

“The events of instruction are designed to make it possible for learners to proceed from “where they are” to the achievement of the capability identified as the target objective. In some instances these events occur as a natural result of the learners interaction with the particular materials of the lesson…the exact form of these events (usually communications to the learner) is not something that can be specified in general for all lessons, but rather must be decided
for each learning objective. The particular communications chosen
to fit each set of circumstances, however, should be designed to
have the desired effect in support the learning process.” (Gagné et
al 1992, p 189)

The scale of the “events of instruction” is implied in the above quote as being temporally smaller than a “lesson” and Gagné, Briggs and Wager provide examples of learning activities for each of nine “events of instruction” that clearly indicate that all of the events fit within a “lesson”. To illustrate, the example provided for the first “event of instruction”, “Gaining Attention” is:

“Present initial opening instructions on screen, including some displays that change second by second. Call attention to the screen presentation, using words like “Look!”, “Watch!”, etc.” (Gagné et al 1992, p 201)

The activities described in the above example of “the “Gaining Attention” event obviously have a short duration that could be measured in minutes or seconds and hence represent the micro level of learning activities. Gagné Briggs and Wager list the nine “events of instruction” in chronological order as:

“1. Gaining attention

2. Informing the learner of the objective

3. Stimulating recall of prerequisite learning
Chapter 2. Existing Theories of Learning Technologies and Learning Activities.

4. Presenting the stimulus material
5. Providing learning guidance
6. Eliciting the performance
7. Providing feedback about performance correctness
8. Assessing the performance
9. Enhancing retention and transfer” (Gagné et al 1992, p 190)

The nine “events of instruction” form an often-used basis of the design of lessons and the activities that occur in them. For the purpose of this thesis a shortcoming of the “events of instruction” is the constraining of them to the duration of a lesson. While this is clearly appropriate for scheduled face-to-face classes, it is not necessarily suited to adult education where flexible approaches to time spent learning are essential for learning to fit with other time constrains such as family work etc. Although Seels and Glasgow (1990) also divide the process of instruction into a chronological sequence of learning events, which bears a close resemblance to the list provided by Gagné Briggs and Wager, they do not confine their steps, or events of instruction to a lesson of fixed length.

“Whatever the size of the instructional segment, there is a set of events generally prescribed for all learning situations”. (Seels and Glasgow 1990, p 161)

Seels and Glasgow continue to describe the events as:
Chapter 2. Existing Theories of Learning Technologies and Learning Activities.

“1. introduction to gain students’ attention
2. presentation of information, facts, concepts, principles or procedures
3. transitional practice designed to help students bridge the gap between entry level behaviour and behaviour required by the terminal objective(s)
4. criterion practice and
5. criterion test.” (Seels and Glasgow 1990, p 160)

They also indicate that guidance is given and feedback received in steps three and four.

Romiszowski (1981) uses the terms “instructional method”, “strategy” and “tactic” to describe what the instructor will do during instruction” (Romiszowski 1981, p 276). He defines methods and strategies as broad approaches as in “the tutorial method” and “active learner participation” strategy that are broad, guiding philosophies of the instruction to be designed. Instructional tactics are described by him as the specific ways a particular method is implemented in detail and he suggests that they are often, in practice left up to the “classroom instructor”. Romiszowski also describes “instructional exercises” as “the actual activities and events that occur when a particular tactic or set of tactics that make up the lesson are put into practice” but suggests that these too are “left to the classroom teacher” (Romiszowski 1981, p 277).

The categorisation of learning activities by the role they play is clearly very helpful in the design of learning activities, especially in the context of
classroom teaching and learning as it provides designers with smaller chunks of activities to which “instructional tactics” can be applied. The conceptualisation of learning activities by Seels and Glasgow and by Gagné, Briggs and Wager are not suited to the purpose of this thesis as they do not classify or categorise learning activities into groups that can then be applied to individual learning technologies and especially in the case of Gagné Briggs and Wager the activities are clearly intended to be used in classroom teaching where learning technologies are employed as adjuncts rather than as central to the learning process. These conceptualisations are thus not appropriate for use in a technology selection method where learning technologies are matched to learning activities.

2.5.2. Tacit Classification and Categorisation of Learning Activities.

Other contributors to the literature, while not setting out to overtly classify learning activities, have tacitly provided degrees of classification of them. In an earlier section of this chapter several classifications of learning technologies (Bates 1995, Taylor 2002, Rowntree 1994) were discussed, each of which implies a classification of learning activities. Bates’ descriptions of learning technologies as one-way or two-way implies that there are one-way and two-way learning activities and it follows that learning activities that utilise technologies in these ways can be classified as:

- interactions with the material using the one-way technologies, and
- interactions between people using the two-way technologies.
Taylor (2001) provides corroboration of this tacit conceptualisation in the description of the Generations of Distance Education (Table 2.1), where technologies are categorised as providing “Highly Refined Materials” and/or having “Advanced Interactive Delivery”. Further, Rowntree (1994) implies a similar tacit categorisation of learning activities by categorising “media” as those for human interaction and those for interaction with materials. It is not surprising that learning activities can be categorised as interactions with materials and interactions between people as this is reflected in many learning experiences.

While this tacit categorisation of learning activities is a useful starting point for the conceptualisation of learning activities, it requires further development and greater detail for it to be useful in the selection of learning technologies.

2.5.3. Classification and Categorisation by Lists and Examples.

In a number of instances in the literature (Seels and Glasgow 1990, Smith 1995, Beard and McPherson 1999), rather than providing a conceptualisation of learning activities, commentators have chosen to provide a list of instructional methods or examples of learning activities. Seels and Glasgow (1990) suggest that methods are instructional strategies or models of teaching, that “determine the nature of the lessons” and that:
“a method is a way to structure the learning experience at the lesson level rather than the curriculum level.” (Seels and Glasgow 1990, p 180)

They provide examples of methods that include: lectures, laboratory, discussions, readings, field trips, note-taking, demonstrations, programmed instruction, case studies, role-plays, exercises, independent study, and simulations. Beard and McPherson (1999) provide a comprehensive list of thirty-four “training methods” that include classroom-based learning activities as well as some learning technologies. They provide a short description of each “method” and notes on the “trainer’s perspective” and the “end user’s perspective”. While lists of methods are useful to the learning event designer they are not useful for the purpose of this thesis, as they do not provide a direct link to any one learning technology, do not facilitate an understanding of learning technologies and in many cases the “methods” could be facilitated by any of a number of technologies.

2.6. Conclusion

Since World War II, learning technologies have changed in the role they play, their complexity and their proliferation. At the turn of the twenty-first century, with the burgeoning adoption of the new Internet-based technologies and an accelerated rate of technological change, the role of learning technology is more entrenched in the institutions and organisations than ever before.
There are two different frameworks by which learning technologies are classified or categorised and for clarity, in this thesis the following differentiation has been made. Learning technologies are classified according to the characteristics of the technologies and categorised according to the role they play in learning. For example Leshin, Pollock and Reigeluth (1992) classify learning technologies as human, print, visual, audio/visual or computer-based and Laurillard (2002) categorises learning technologies as supporting “interpersonal and internal dialogue forms”, namely Discursive, Adaptive, Interactive and Reflective.

While classification of learning technologies according to their characteristics can be helpful to those who use the technologies at the time, such systems do not always cater for new technologies and classification systems are prone to limited currency in an environment of rapid technological change. Categorisation systems of learning technologies, on the other hand, change only when new or different learning activities emerge.

As Higher Education and Human Resource Development adopt flexible approaches to learning, as described in Taylor’s (2001) Fourth and Fifth Generations of Distance Education (Table 2.1), the role of learning technologies has changed from one of being adjuncts to the learning process to one of centrality in which technologies are the prime mediators of communications between learner and materials, learner and facilitator and between learners.
As learning technologies and their roles have changed, the terminology used to describe them has changed as well. In places the terms “media” and “technology” have been used interchangeably and the term “teaching aids” had currency when technologies were used as only adjuncts to learning. Today, new terms have entered the vernacular of Higher Education and Human Resource Development to describe the breadth and depth of the impact of new Internet-based learning technologies; for example, “Online Learning” and eLearning.

There are several reasons to classify and/or categorise learning technologies. On the broadest level such investigations, through the provision of conceptual or theoretical frameworks, assist our understanding through the indication of similarities and contrasts that can lead to generalisation or specialisation. On a more narrow and applied level, through the process of technology selection, a deeper understanding of learning technologies can assist in their application to the learning process in a fashion that is appropriate to the learners, the material, the context and the budget.

The conceptualisations of learning technologies in the literature are not suitable for the purpose of this thesis. Some were found to be limited to descriptions of technologies by their form and as such add little to our understanding of their application to learning. However, the conceptualisations presented by Taylor (2001), Bates (1995) and
Rowntree (1994) provide the basis of a theoretical framework through the division of learning technologies into categories of one-way and two-way. The technologies in the one-way category primarily facilitate learners’ interactions with materials while those in the two-way category facilitate interactions between people. The conceptualisations of learning activities in the literature are not suitable to the purpose of this thesis. In many cases they were designed for other purposes and generally were intended for application in face-to-face, classroom-based learning events. However, tacit conceptualisations of learning activities as by-products of the conceptualisation of learning technologies provide the basis of a theoretical framework of learning activities that can be used in a technology selection method. As learning technologies can be grouped as one-way or two-way, it follows that learning activities, in the same context, can be grouped as one-way, interactions with materials or two-way interactions between people. This symmetry of the bases of theoretical frameworks forms the foundation upon which the Technology Selection Method, developed in the second part of this thesis is built. Before the theoretical frameworks and Technology Selection Method are developed the literature concerned with the selection of learning technologies in the fields of Higher Education, Human Resource Development and Instructional Design is reviewed to evaluate current and past practice.
Chapter 3

Existing Methods for the Selection of Learning Technologies.

3.1. Introduction.

In the recent past the role of learning technologies in Human Resource Development and Higher Education has changed and today technology plays a central role in learning in many subjects and programs. In several places in the literature, learning technologies have been classified and categorised, resulting in the development of theoretical or conceptual bases upon which an understanding of the nature and role of learning technologies can be built. In many cases these bases are intended to inform the process of decision-making regarding the planned use of learning technologies with some degree of confidence in the appropriateness of the result. Two clear levels of decision-making
regarding the use of learning technologies have been identified in the literature as the strategic and tactical (Bates 1995).

The capital and infrastructural costs of some learning technologies dictate that decisions to use them are typically made at the executive level of the institution or organisation. Less expensive, yet important to the learning process, are the decisions made by designers of learning events as to what material or learning activities are to be mediated or facilitated by each technology. These are referred to as strategic and tactical decisions, where strategic decisions are of the nature to invest in a technological system and tactical decisions are concerned with the nature of the use of the technology in the achievement of a particular learning objective. Both strategic and tactical decisions regarding learning technologies are made for development of human resources in organisations and for education at universities and colleges.

An example of a strategic decision at the institutional or organisational level, is the decision to invest in the equipment and infrastructure needed to offer web-based learning, whether to purchase a commercial Learning Management System (LMS) or to build one that precisely suits the specific needs of the institution or organisation. At the level of the designer of learning events, tactical decisions are made in terms of what technological elements of the Learning Management System will be used and what parts of the learning events will they be used for.
As mentioned in the previous chapter there are parallels between the history of the use of technology in Human Resource Development, Higher Education and Instructional Design. There are several instances in the literature (Smith 1992, Wilson 1999, Gagné et al 1992, Berge 2001) where changes in terms and approaches in the education sector have been adapted for use in training and development in the contexts of Human Resource Development and Instructional Design. When compared to traditional, classroom teaching and learning, Open Learning, Distance Learning and Flexible Learning as educational paradigms have all impacted upon the way in which learning events are provided and the way that learning technologies are used. These new paradigms, have impacted on organisations and when applied to training and development can provide reductions in costs of training and advantages in timing through the introduction of flexibility of when and where training occurs. As in Higher Education, the application of these paradigms in Human Resource Development often involves an increase in the use of learning technology and the separation of learner from the facilitator. In particular the Internet and the World Wide Web have had an impact large enough to generate a new approach to training and development and the concomitant terms. For example “Web-Based Training” (WBT) (Khan 2001) and “Technology-Based Training” (TBT) (Kruse and Keil 2000) provide approaches to training that rely on the World Wide Web alone in the case of WBT and the Web plus CD-ROM in the case of TBT. While the literature on these single or limited technology approaches to training is quick to point out the advantages to be gained, it does not dwell on the
limitations inherent in an approach that is limited to one or two technologies even though one of them is as powerful and ubiquitous as the Internet. However, the purpose of this thesis is not the evaluation of technological approaches rather it is the consideration of theoretical frameworks for learning technologies and learning activities as well as methods of technology selection.

The adoption of the new learning paradigms has been facilitated in part by the advent and spread of the Internet and the World Wide Web. The flexibility of being able to learn when it best suits the task, the individual or the organisation has an obvious potential to increase productivity and has given rise to the concept of Just In Time training. Compared to face-to-face extraction training, Just In Time training is usually on-the-job and can provide gains due to the training being received precisely when it is required to perform a new task. As well, there is reduced disruption to working hours. Another benefit occurs if the training materials are encapsulated in, and delivered by a learning technology, as they can be available for reinforcement when and where it is needed. However, due to the absence of the instructor or trainer, to immediately interact with learners, the technology must be able to facilitate the complete learning experience or at least provide direction to the location of answers to learners’ queries. The learning technology used must be appropriate to the learner and the organisation and selected to do so efficiently and effectively so that the benefits of flexibility are maintained. Existing approaches to the selection of learning technologies are reviewed in the
following sections. As the methods suggested in the literature of Instructional Design are limited and are generally applied to Human Resource Development and Higher Education, the reviews of them have been combined and the following sections review methods of technology selection for Human Resource Development and Higher Education.

Another area that investigates methods of technology selection is Organisational Communications. As the efficiency of communications between managers and other members of an organisation has clear links to profits, a sturdy body of literature that conceptualises and theorises the selection of technologies for communications has developed. This literature is reviewed later in this chapter.

### 3.2. Technology Selection in Human Resource Development.

The literature concerned with the selection of technology for training and development in Human Resource Development, appears under-theorised and characterised by guides to technology selection or lists of factors to be considered when selecting them. The guides to selection range in complexity and usually suggest one or more technologies from a finite list. For example “The Media Analysis Model” (Lee and Owens 2001) is based on twenty-four questions to be answered on a scale of one to five. The questions are listed in Table 3.1.

In the Lee and Owens Model the questions are grouped into two categories entitled, “Instructional/Student factors” and “Cost Factors”. The questions are mainly broad in nature and concern the characteristics of
the material and the audience or are about the budget or the potential return on investment.

<table>
<thead>
<tr>
<th>Instructional/Student Factors</th>
<th>Cost Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content requires interactivity (computer)</td>
<td>Content has a short shelf-life or changes rapidly</td>
</tr>
<tr>
<td>Incidental learning may occur</td>
<td>Global audience - Multiple cultures or languages</td>
</tr>
<tr>
<td>Collaborative learning is desired</td>
<td>Materials must be available in a variety of formats</td>
</tr>
<tr>
<td>Content requires interactivity (human)</td>
<td>Audience level – Fewer than 200 per year need training/support</td>
</tr>
<tr>
<td>Audience requires motivation</td>
<td>Must accommodate large numbers of participants – 2000 or more per four years of shelf life</td>
</tr>
<tr>
<td>Audience requires convenience – training at or near work site</td>
<td>Must train large numbers of employees quickly</td>
</tr>
<tr>
<td>Audience has limited access to required technology</td>
<td>Requires compression of training time</td>
</tr>
<tr>
<td>Audience has limited access to required expertise</td>
<td>Keep development costs per hour of instruction low</td>
</tr>
<tr>
<td>Students are resistant to new media</td>
<td>Keep travel expenses low</td>
</tr>
<tr>
<td>Employees must review the information frequently</td>
<td>Keep implementation delivery, and maintenance costs low</td>
</tr>
<tr>
<td>There is an immediate need for application of expertise to the job</td>
<td>Testing, evaluating or tracking student performance is necessary</td>
</tr>
<tr>
<td>Wide variation in entry-level background knowledge</td>
<td>Tracking course completion is necessary</td>
</tr>
</tbody>
</table>

Table 3.1. Instructional and Cost Factors: Questions in the Media Analysis Model (Lee and Owens 2001, pp 8-13).

After collating the results, Lee and Owens’ Media Analysis Model is used to prescribe suitable learning technologies from a list. The list of “media” from which the recommendations of the model are made is:

- Audio tapes,
- Audio teleconference,
- Computer-based,
- Satellite broadcast,
Instructor-led,
- Performance support,
- Self-paced workbook,
- Video teleconference,
- Video tapes,
- Web-based” (Lee and Owens 2001, p 14)

The confusion with the terms “media” and “technology” was discussed in Chapter One and it appears that the confusion is also evident here, in the field of Human Resource Development as Lee and Owens use the term “media” to describe both technologies and media.

Another example of a technology selection method used in Human Resource Development is the “Training Design and Development Media Selection Model” (Scheer 2001) which was developed to meet the “train the trainer” needs of the IRS (USA taxation agency). The model is a complex flowchart containing thirteen questions that lead to a range of technologies and methods that are suggested as suitable for the situation. In the “media selection” section of the model the questions asked concern the nature of the learning outcome or the demographics of the learners. For example; the questions ask are the trainees geographically dispersed or is the same training is required by a number of trainees at the same time and is the content knowledge or skills. Unfortunately the Lee and Owens model and the Scheer model are limited due to their prescriptive nature and that the technologies they prescribe are only those available
when the models were published. As the models do not inform the user of the nature and characteristics of each technology they cannot be easily extended and used to select technologies developed after their publication.

Another approach to technology selection for Human Resource Development that is a less instructive or prescriptive, is to provide a list of factors to consider or questions to answer when selecting and to provide no directions for the selection process. For example the website for Instructional Systems Designers Inc. lists the following eleven points to be considered:

- What are my objectives?
- What learning styles am I attempting to address?
- What is the size of my audience?
- Will the training be self-instructional?
- What is cost-effective?
- How much time do I have to develop this?
- Is a high level of final performance required?
- How quickly will the media I am considering change in format and availability?
- How often will the training be updated?
- Should I buy off the shelf or create from scratch?
- Does it promote interest and interactivity?” (Instructional Systems Inc. 2002)
As in the Lee and Owens model and the Scheer model, the questions in the Instructional Systems Inc. model can be seen as questions about costs and questions about instructional or student factors. The Instructional Systems model is certainly not prescriptive but it fails to guide users through the selection process. McPherson and Beard (1999) take a different approach to the selection of technology. They do not differentiate between the selection of technology and the selection of methods. They provide no model, method or process of technology selection, rather they provide a limited number of examples and a large table of methods and technologies. The table lists the following methods and technologies and contains a short description of each as well as notes on the perspectives of the “trainer” and the “End User”.

In a similar fashion Smith (1992) does not provide a method, model or process for the selection of technology. Rather, in a chapter entitled: “Methods and Media”, he describes in some depth the technologies of video, computer-based training and interactive video. Others also appear to limit the technologies recommended for Human Resource Development. As mentioned earlier, Kruse and Keil (2000) present an approach entitled: “Technology-Based Training (TBT)” in which the technological options are limited to multimedia CD-ROM and web-based training. While this may appear to be a technological limitation, Kruse and Keil point out that the two technologies have many benefits, such as flexibility of time and place of learning. They also point out that for asynchronous training using these technologies, one of the disadvantages is the reduced social interaction. They propose a simple decision grid to select the more appropriate of the two technologies based on the two criteria: frequency of updates and whether or not audio and video are required. Romiszowski and Chang (2001) analyse the uses of the World Wide Web in training and categorise them as individual and group study modes. The details of this categorisation are shown in Table 3.2.

<table>
<thead>
<tr>
<th><strong>Individual Study Mode</strong> (CBT-WBT*)</th>
<th><strong>Group Study Mode</strong> (CMC-WBT*)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Online Use or Synchronous Communication</strong></td>
<td>Browsing the Web, accessing Websites for information or CBT modules</td>
</tr>
<tr>
<td><strong>Offline Use or Asynchronous Communication</strong></td>
<td>Downloading courseware from the Web for later study on local computers</td>
</tr>
</tbody>
</table>

*CBT: Computer-Based Training, WBT: Web-Based Training, CMC: Computer Mediated Communications

Table 3.2 CBT-WBT and CMC-WBT

*(Romiszowski and Chang 2001, p 109)
Romiszowski and Chang address the question of the appropriate variety of WBT and argue that: “all four basic categories of WBT have their respective roles to play in modern education and training systems” (Romiszowski and Chang 2001, p 110). However they single out the category of Asynchronous CMC for treatment for the following reason.

"It is, arguably the category of WBT that has most to offer for the future improvement of corporate education and training."

(Romiszowski and Chang 2001, p 110)

Both Kruse and Keil and Romiszowski and Chang concentrate on one or two technologies and suggest they can meet most training needs. Unfortunately this approach to the application of technology to learning is limited by the same characteristics as the Lee and Owens and the Scheer models. By prescribing one or two technologies little opportunity for the provision of an insight to other technologies and no allowance in the selection method for technologies developed later.

Training and development is important to individuals, as there is little doubt that opportunities for increased income and job satisfaction can be gained. Training and development is also important to organisations. While it is difficult but not impossible to find a direct correlation between development and the performance of the organisation, the importance of training is that it can increase the performance of employees and thereby increase efficiency and competitive advantage. However, training has real

associated costs and ways to quantify costs must be available if the organisation is to calculate the return on the training or development investment. As the selection of appropriate learning technologies can be reflected in the efficiency of training and as training can result in increases in productivity, it follows that a correlation can exist between the selection of appropriate learning technologies and productivity.

Human Resource Development is not the only area in which the selection of technology is practiced in organisations. For some years managers have been considering the selection of technologies for communications within organisations. The depth of consideration is reflected in a body of literature that is larger than that of technology selection for Human Resource Development. While there is an obvious overlap between communications and Human Resource Development this is not reflected in the literature of technology selection of each area. In fact the discourses are quite discrete. However, the literature of selection of technologies for Organisational Communications is briefly surveyed here for comparison and to investigate the application of its theoretical and conceptual frameworks to technology selection for learning.

3.3. Technology Selection for Organisational Communications.

Selecting appropriate technologies for communicating within an organisation is important to managers and there are many instances in the literature of Management and Organisational Communications where quite clear definitions of the outcomes of appropriate technology selection are
provided. For organisational communications, the outcome of the selection of technologies that are appropriate to the task and personnel, is the reduction of uncertainty, ambiguity or equivocality (Carlson and Davis 1998, Guthrie 2001, Lee and Heath 1999). This quite conceivably leads to increases in profit through increased efficiency. For training the outcome is an increase in human performance ((Wilson 1999, Nadler 1994, Nordhaug 1993) which again is conceivably linked to increases in performance through increased productivity.

Studies have shown that the majority of a manager’s time is spent communicating (Rice and Shook 1990). Carlson and Davis (1998) reinforce this thus: “Communications activities account for a significant portion of the working time of managers” (Carlson and Davis 1998, p 1) and other commentators indicate the significance of communications to management.

“… some authors have gone so far as to consider organizations as solely communication phenomena, that is, entities developed and maintained only through continuous communication activity among their participants.” (Farace et al. 1997, Weik 1979 in Carlson and Davis 1998, p 1)

Through this significant proportion of time spent communicating, managers are coming to terms with their environments, reaching decisions and coordinating activities of the organisation. The centrality and
importance of communications to management is reflected in the degree of theorisation and discourse on the selection of technologies with which the communications are made.

A number of studies have developed theories of the selection of technologies for organisational communications. The theories have been divided into two categories and are referred to as “Trait Theories of Media Selection” and “Social Interaction Theories of Media Selection” (Guthrie 2001, Carlson and Davis 1998). Trait theories suggest that users match the medium to the communications task. For example Media Richness Theory, developed by organisational scientists (Daft and Lengel 1984), describes “media” as having degrees of richness depending on the number of communication cues available (for example vocal attributes and/or body language), the ability to provide immediate feedback, personalisation, and others factors. Media Richness Theory then states that the higher the equivocality or uncertainty in the communication the richer the “medium” needs to be.

Another of the trait theories, Social Presence Theory, states that technologies differ in the extent to which a user “psychologically perceives other people to be physically present when interacting with them” (Carlson and Davis 1998, p 4). This theory suggests that users understand that different technologies support different levels of social presence and that their choice of technology is based on the level of social presence required by the task or type of communication. Media Richness and Social
Presence theories are very similar and both rank technologies in the same order with face-to-face communications being the richest or supporting the greatest level of social presence at the top of the scale and written communications at the bottom of the scale.

Later research (Guthrie 2001, Carlson and Davis 1998) has indicated that the choice of “media” has been complicated by the introduction of the recent Information and Communications Technologies (ICTs) and that the approach taken by the trait theorists fails to take into account the attributes offered by these new technologies. For example, Media Richness Theory suggests that the telephone is richer than written communications as it can provide the “communication cues” of vocal attributes such as emphasis, pauses, pace, timbre, as well as words. However, the new capabilities of email and computer mediated communications, such as:

- storage,
- retrieval options,
- control over participation and access,
- raising and lessening of status, and
- choice of synchronous or asynchronous communication,

are not taken into account as only communication cues are compared.

The second category of theories of technologies selection, the Social Interaction Theories, suggest that the technology selection process is vastly more complex than simply matching attributes of technologies to tasks. As well these theories provided a response to the problems ICTs
posed for Media Richness Theory and the other trait theories by considering that a combination of social factors was the prime influence on technology selection. While matching of technologies to tasks using the Media Richness or Social Presence scales was appropriate in some cases, there were other cases where other attributes of the technologies were as important, or more important, in the selection of one technology over another. Each of the theories in the Social Interaction category approach technology selection from the perspective that:

“…organizations are webs of interaction, and the basis for interaction among members is a shared system of meaning.”  
(Carlson and Davis 1998, p 5)

The pre-eminent theories in this category include Symbolic Interactionism (Carlson and Davis 1998), Social Information Processing and Structuration Theories.  Structural Symbolic Interactionism, a framework based on Symbolic Interactionism, proposes that social context is the major influence on technology selection. For example within this framework, the decision-making process of technology selection is based on such factors as distance between participants, time constraints and access or connection to the technology.  Also based on Symbolic Interactionism, Social Information Processing Theory has the basic premise that meaning is socially constructed. This theory describes specific mechanisms by which interpretations and descriptions of the work environment influence behaviour and attitudes.  It suggests that workers in the same environment
develop criteria with which they point out the salient features, and interpret the features of technologies.

Structuration Theory, another of the Social Interaction Theories, describes social interaction as an iterative process compared to the sequential processes described in Social Information Processing and Symbolic Interactionism. Adaptive Structuration describes the structure of a group as both a “medium” and an outcome of group interaction with technology. Members of the group select specific features of the “medium” to use in interactions and thus shape the way the “medium” affects the group. The technology is then both a “medium” and an outcome of human interaction. Similarly properties of institutions are both an influence on, and are influenced by interactions with technology.

Clearly the factors impinging on the decision making process of technology selection are many, complex and contextual. In the absence of a single, robust theory of technology selection managers need to examine the fundamental aspects of the technology as well as the social context in which it is to be used if they are to select technologies that are appropriate to the task.

“Mangers should choose to enact features of a media [sic] rather than choosing the media [sic] per se.” (Guthrie 2001, p 1)
For the past twenty to thirty years, research regarding a theoretical basis for selecting technologies to be used for organisational communications has been as widespread as it has been inconclusive. The volume of research published in the area is testament to the importance with which the development of a single and robust theory of technology selection is viewed but as yet the quest for such a theory continues. If such a theory will lead to an increase in communications efficiency, which in turn will result in a decrease in uncertainty or equivocality within organisations, it is almost certain that productivity will increase. It is then easy to understand why managers are prepared to foster the high degree of research in this area. Likewise the literature of Human Resource Development is clear in stating that development of the human resources of an organisation should lead to increased productivity. However, it is clear that the area of technology selection for Human Resource Development is considerably less theorised than its Organisational Communications counterpart. While the establishment of the reasons for this discrepancy would in all likelihood form a fascinating study it is beyond the scope of this thesis to do so.

Of the families of theories of technology selection for Organisational Communications, the Trait Theories have the greatest to offer as the basis of a theoretical framework that can be used in technology selection. Trait theories such as the Media Richness Theory rank technologies in order of the communications cues or channels they support. In this way a hierarchy of technologies can be constructed in which “rich” technologies such as videoconference with visual and vocal communications channels would be
rated as having a different level of attributes when compared to technologies like email which is generally limited to text.

3.4. Technology Selection in Education.

The literature regarding technology selection in education reflects the changed role of learning technology in flexible approaches to education. Learning technologies as described in the literature can be quite easily divided between those for traditional classroom teaching and learning, and those for Flexible Learning. The literature describing technology selection for traditional, face-to-face, classroom teaching and learning does not agree on a single coherent statement of purpose or outcome for the selection of appropriate technology. Some commentators give no reason other than that educators and designers of courses spend a great deal of time and effort engaged with the task of technology selection while others cite reasons of enhancing the teaching presentation (Romiszowski 1988, Seels and Glasgow 1990). Later commentators on Distance Education, Open Learning and Flexible Learning cite other, quite different reasons for the selection of appropriate technologies such as cost benefit, innovation (Bates 1995), widened access and increased flexibility (Bates 2000), or to support the process of learning (Laurillard 1995).

The key factor differentiating the role of learning technology in Flexible Learning from traditional face-to-face learning is the degree of the centrality of technology to the learning process. In Flexible Learning technologies play a central role while in traditional learning the role is
generally as an adjunct. Reports of the approaches to technology selection for Flexible Learning and traditional learning in the literature are reviewed in the following sections.

3.4.1. Technology Selection in Traditional Learning.

In traditional learning technologies are typically used only as adjuncts to face-to-face, classroom teaching, while in Flexible Learning, technologies provide materials to learners and mediate the communications between learners and between learners and the facilitator. In traditional learning, learners and the facilitator are in the same place at the same time and the technology in this setting has adjunct and illustrative uses, for example:

- to display records of events or phenomena that are difficult to reproduce in the classroom, expensive or dangerous
- To screen movies of theatrical performances of plays and literary works, and
- Illustrations that exemplify or explain difficult concepts.

Most commentators on technology selection for traditional learning recognise that selection is part of the design process (Gagné, Briggs and Wager 1992, Seels and Glasgow 1990, Romiszowski 1988, Reiser and Gagné1983). However, only a limited number go further than recognition and put forward lists of factors to be considered or models for technology selection. For example Gagné, Briggs and Wager (1992) suggest that there are three categories of factors contributing to “media selection”.


“…models of media selection typically include three categories of factors contributing to the narrowing of choices. These are (1) physical attributes of the media, (2) task characteristics, and (3) learner characteristics.” (Gagné et al 1992, p 211)

While lists of factors to be considered, or models for technology selection have been developed and have been used for many years for selecting technologies that are appropriate for use in the classroom, they are limited to classroom use as the technologies are generally used for very small parts of the learning event. These models are limited in their applicability to the selection of technologies that can be used for larger sections of learning events and it has been argued (Bates 1995) that the limitations of these models are sufficient to render them not suitable for the selection of appropriate technologies for use in Flexible Learning.

In traditional learning, apart from the standard equipment (eg whiteboards, overhead projectors etc), the decision of what technology to use is typically made by the teacher and based upon resources that are available, relevant and affordable. There is little or no reason for other technology selection decisions to be made at the level of the institution unless it is for the installation of a major facility such as a computer laboratory or a network of television receivers.

In Flexible Learning technology selection is of greater importance due to its centrality to the process of teaching and learning. The decision to use
a particular technology is made at a strategic level and the ways in which the technology is used is made at a tactical level.

3.4.2. Technology Selection in Distance Education, Open Learning, Flexible Learning and Online Learning.

In the previous chapter, predominantly through the work of Taylor (1997, 2001) a link was shown to exist between Distance Education, Open Learning, Flexible Learning and Online Learning and it has been argued that Flexible Learning and Online Learning form a later “Generation” of Distance Education (Taylor 2001). For this reason as well as the following shared characteristics they are treated here as one group.

- they share the characteristic that for at least some of the teaching time students and teachers are separated in time and or space;
- they require some level of technology selection at an institutional level; and
- technology is used to provide materials and as the central or only communication between teachers and students.

Technology selection in Distance Education, Open Learning, Flexible Learning and Online Learning has two levels; the strategic and the tactical, as described in the beginning of this chapter. Strategic decisions, usually made at the upper management levels of institutions might concern investment in technologies such as videoconference or a Web-based Learning Management System. Tactical decisions, usually made at the level of designer or facilitator of learning events, might concern what parts
of the learning to use videoconference for or what parts of the Learning
Management System should be used for particular parts of the learning.

Figure 3.1 “Route Map for Materials Preparation” (Rowntree 1994, p 5)
Rowntree (1994), writing about tactical decisions in “An Action Guide for Teachers and Trainers”, situates a section called “Choose Your Media” in the planning stage of his “Route Map for Materials Preparation” (Figure 3.1). As a guide to the process of “choosing your media” he puts forward eleven possible questions to be considered in the selection of learning technologies.

“1. Do any of the learning objectives dictate certain media?
2. Which media will be physically available to the learners?
3. Which media will be most convenient for the learners to use?
4. Are any media likely to be particularly helpful in motivating learners?
5. Are you under pressure from the organisation to use/avoid certain media?
6. Which media will you (the teacher/trainer) be most comfortable with?
7. Which media will learners already have the skills to use?
8. Which media will you (the teacher/trainer) have the necessary skills to use?
9. Which media will you be able to afford to use?
10. Which media will learners be able to afford to use?
11. Which media might you call on to back up the main media and/or to ensure adequate variety?” (Rowntree 1994, p 67)
Rowntree goes on to list a range of “media” and provides a matrix in which some “media” are prescribed for some learning tasks. For example he links “telephone tutoring”, which he labels as one of the available “media”, to the tasks; “build each learner’s ideas into the teaching” and “ask learners to answer questions about the subject” (Rowntree 1994, p68).

The matrix lists; print, audio, video, interactive video, practical work, computer tutoring, computer simulation, multi-media, computer conferencing, lecturing, face-to-face tutoring, telephone tutoring and correspondence tutoring as some of the “more common media” (Rowntree 1994, p 68). Rowntree’s questions and matrix can clearly be helpful to designers who wish to use technology in the learning events they design. While the questions are broad and could be applied to most technologies, the matrix is limited to the finite number of technologies it contains.

Rowntree’s matrix is prescriptive and does not provide designers with an insight to the characteristics or nature of the technology. For these reasons Rowntree’s matrix is of limited value to designers today whose designs may include technological elements of web-based Learning Management Systems, a technological system that was not available at the time that Rowntree was writing.

Bates proposes a “Course Development Process” (Figure 3.2) which has been designed for:

“…the rapidly increasing number of people in educational institutions, government departments, training organisations, and

businesses who are seeking to find more cost-effective means to provide quality education and training to their students or clients, and who are considering the use of technology-based open learning and distance education to meet those needs.” (Bates 1995, p 1)

| 1 Course outline developed | Target group identified  
|                           | Place in curriculum identified  
|                           | Content agreed  
|                           | Teaching approach agreed  
| Project manager           |  
| Subject experts           |  
| Instructional designer    |  

| 2 Selection of media | Access  
|                      | Costs  
|                      | Teaching functions  
|                      | Interaction/user-friendliness  
|                      | Organisational issues/existing facilities  
|                      | Novelty  
|                      | Speed  
| Project manager       |  
| Subject experts       |  
| Instructional designer |  
| Media specialist      |  

| 3 Development/production of materials | Copyright clearance  
|                                       | printing  
|                                       | Audio production  
|                                       | Video production  
|                                       | Computer-based materials  
|                                       | Tutorial arrangements  
| Project manager                     |  
| Subject expert(s)                   |  
| Instructional designer              |  
| Media specialist                    |  
| Senior tutor                        |  
| Operations manager                  |  

| 4 Course delivery | Warehouse  
|                  | Packing  
|                  | Mailing/transmission  
|                  | Tutoring  
|                  | Library services  
|                  | Student assessment  
|                  | Course evaluation  
| Project manager  |  
| Subject expert(s) |  
| Instructional designer |  
| Tutors             |  
| Operations manager |  
| Exams officer      |  

*Figure 3.2 “The Course Development Process” (Bates 1995, p 49)*

Bates advocates the use of a model and argues that the desirable characteristics of a model for technology selection are as follows.

- it will work in a wide variety of contexts;
- it allows decisions to be taken at both a strategic, or institution-wide, level and at a tactical, or instructional, level;
- it gives equal attention to instructional and operational issues;
- it will identify critical differences between different technologies, this enabling an appropriate mix of technologies to be chosen for any given context.
- it will accommodate new developments in technology.” (Bates 1995, p 35)

Bates states that his model or practical decision-making framework, entitled the “ACTIONS model” (Access Costs Teaching functions, Interactivity, Organisational issues, Novelty, Speed) can be used by “policy-makers, education and training planners, senior education administrators, teachers and trainers” (Bates 1995, frontispiece). However, the lack of a method or model of the selection process limits the suitability of this model for the designer making tactical decisions. Bates was writing in the context of the United Kingdom Open University, a Distance Education/Open Learning university of over 100,000 students and while his process is useful to large distance education providers where the team approach to all stages of curriculum design, including “selection of media”,
can be afforded, its value is limited in cases where the designer is the facilitator or the design team is very small.

Also contributing to the Distance Education literature, Moore and Kearsley (1996) propose a “Systems Model for Distance Education” (Figure 3.3) in which they attempt to broaden the approach taken by Bates, by including the learning environment in the model. However, like Bates’ model, Moore and Kearsley’s model is designed for large Distance Education organisations that can afford a team approach and while their model is suited to this approach it provides limited guidance for individual designers who are not skilled in Instructional Design or in cases where the designer is also the facilitator or the design team is very small. Moore and Kearsley are quite clear in specifying a team approach to the design of learning events using their model.

“While there are content experts who have both instructional design skills and knowledge of technology, it is better if these responsibilities are carried by different specialists ... Graphic designers, producers, and other media specialists should be brought in to turn the ideas of the content experts and instructional designers into good-quality course materials and programs.” (Moore and Kearsley 1996, p 9)
Moore and Kearsley provide a limited treatment in the area of selection of technology. They argue that “first of all we must keep in mind that each medium has its strengths and weaknesses” (Moore and Kearsley 1996, p 95). They then continue to outline the strengths and weaknesses for print, audio/video, radio/television, teleconferencing and computers. Moore and Kearsley state that other considerations in the selection process include the degree to which students require motivating, the budget and the context. They then provide four main steps in technology selection.

1. Identify the media attributes required by the instructional objectives or learning activities.
2. Identify the student characteristics which suggest or preclude certain media.
3. Identify characteristics of the learning environment which favour or preclude certain media.
4. Identify economic or organizational factors which may affect the feasibility of certain media.” (Moore and Kearsley 1996, p 97)

The approaches taken to the selection of technology by Bates and by Moore and Kearsley are clearly very informative and helpful in the context of large Distance Education or Open Learning institutions. Like Bates, Moore and Kearsley were writing in the context of large institutions. Moore was writing at the Pennsylvania State University, where he was Academic Director of the Center for the Study of Distance Education and Kearsley was lecturing at the University of Wisconsin, Madison. Like the United Kingdom Open University, Pennsylvania State University and the University of Wisconsin all have significantly large enrolments of Distance Education students and hence can provide Instructional Design resources for the design of learning events including the selection of technology.

Although the approaches taken by Bates and Moore and Kearsley probably work well in the context of a design team of specialists, they do not provide individual designers, with no Instructional Design training, with either a concise method to guide them through the technology selection process or a method that leaves the designer with an understanding of the technology from which they may extend or change the application of the technology to the learning events they design.

In the evolution of Distance Education, represented by Taylor (2001) as the Fourth and Fifth Generations of Distance Education (see previous
chapter), the most recent stages involve the use of the Internet and the World Wide Web and are commonly referred to as Online Learning or eLearning. For the sake of simplicity the term “Online Learning” is used in this thesis to describe learning events in which materials are distributed, in part or whole, and dialogue hosted in part or whole, by an Internet technology. Often this technology is a Learning Management System.

With Online Learning there is a clear differentiation between strategic and tactical technology selection decisions. Online Learning in many cases uses several technologies within the technological system of the Internet. These may include Web pages for the display of learning materials, email for one-to-one or one-to-many communications and discussion lists to emulate classroom discussions. As well there are other specialised tools that can be used to facilitate collaboration between learners using online workspaces. Strategic technology selection decisions in Online Learning concern choices in the purchase, installation and maintenance of the necessary hardware and software such as Learning Management Systems (LMS) servers and commercially available LMS software. Strategic decisions are typically made at the executive level of the institution due to the high cost and systemic nature of such hardware and software. Tactical decisions in Online Learning are in many cases, especially in the medium and small institutions and organisations, made at the level of the individual designer of learning events. The designer may consider what part of the content of a subject the Learning Management System will carry and whether it will be reinforced by other methods or technologies.
Two approaches to Online Learning are emerging in the literature (Bates 2000, Pauloff and Pratt 1999, Harris 1999). They are not mutually exclusive within the context of a course or subject and are:

- learning as the provision of materials, and
- learning as communications between learners and between learners and the facilitator of learning.

The technological functions provided by Learning Management Systems can be divided, more or less, in the same fashion. For example, material can be provided through web pages of text and graphics as well as through streamed video and audio. Communications between learners and between learners and the facilitator can be mediated by email, discussion lists, notice boards and synchronous tools such as chat rooms and desktop videoconference. Often Online Learning is not used as the sole learning technology as print, lectures, tutorials, residential schools and other technologies and methods can form part of the learning experience.

In many institutions and organisations the facilitator of learning undertakes the design of Online Learning events. This includes the selection of technology at the tactical level where learning activities are matched to some or all of the technological elements of the Learning Management System. While the literature contains little regarding the selection of these elements, in several cases institutions have provided guides, which generally do not differentiate between the technical elements of Learning Management Systems and other technologies. For example the guides
provided by the Digital Media Centre at the University of Minnesota (USA), the Outreach Unit at Pennsylvania State University (USA), and the Centre for Educational Development and Interactive Resources at the University of Wollongong (Australia) all combine technologies of Learning Management Systems with others. The guides typically list technologies and provide examples, to differing depths, of the application of some of the technologies to learning. The University of Wollongong’s, Web-based, “Media Matrix”, reproduced in Table 3.3, which was developed separately from the author’s work, clearly indicates the Web as method of “Presentation, “Interaction” and “Delivery” for a number of the technologies. The “Media Matrix” is presented as a tool for the selection of learning technologies and is described thus:

“the Media matrix provides a simple model that invites course designers to explore options and to creatively integrate four dimensions:

- media for presentation and interaction
- presentation of the subject message
- interaction to support the teaching/learning process
- delivery method for presentation and interaction” (CEDIR 2003)
Guides for the selection of learning technologies, such as the University of Wollongong’s “Media Matrix” (Table 3.3) often do not differentiate between technologies that are part of the Learning Management System (LMS) and those that are not. Clearly, in the “Media Matrix” (Table 3.3), technologies such as audiocassettes and textbooks cannot be part of a LMS while email and web-based study guides could easily be so. The combination of LMS technologies and others implies that they are intended to be selected at the same time in the design process. Many of the technological elements that make up a LMS are analogous to other methods or technologies that are not web-based, and this is reflected in the naming of them. For example email, chat room, web page, discussion list, video stream, audio stream. It follows, that as other technologies can be used in conjunction with Learning Management Systems, and as the technological

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<table>
<thead>
<tr>
<th>Medium</th>
<th>Presentation (one-way)</th>
<th>Interaction (two-way)</th>
<th>Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Print</td>
<td>Study guides</td>
<td>Assignment</td>
<td>Mail</td>
</tr>
<tr>
<td></td>
<td>Readings</td>
<td>Comments</td>
<td>Fax</td>
</tr>
<tr>
<td></td>
<td>Textbooks</td>
<td>Student projects</td>
<td>Email</td>
</tr>
<tr>
<td></td>
<td>Digital text</td>
<td>Letters</td>
<td>www</td>
</tr>
<tr>
<td>Audio</td>
<td>Cassette tapes</td>
<td>Cassette tapes</td>
<td>Mail</td>
</tr>
<tr>
<td></td>
<td>Audio CD</td>
<td>Audioconferences</td>
<td>Telephone</td>
</tr>
<tr>
<td></td>
<td>Audioconferences</td>
<td></td>
<td>Voicemail</td>
</tr>
<tr>
<td>Video</td>
<td>Videotapes</td>
<td>Videotapes</td>
<td>Mail</td>
</tr>
<tr>
<td></td>
<td>Videoconferences</td>
<td>Videoconferences</td>
<td>Telephone</td>
</tr>
<tr>
<td></td>
<td>Audiographics</td>
<td>Audiographics</td>
<td>ISDN</td>
</tr>
<tr>
<td></td>
<td>CDROM</td>
<td>WWW</td>
<td>WWW</td>
</tr>
<tr>
<td></td>
<td>WWW</td>
<td></td>
<td>TV</td>
</tr>
<tr>
<td>Multimedia</td>
<td>CDROM</td>
<td>Teaching and learning online</td>
<td>Mail</td>
</tr>
<tr>
<td></td>
<td>Lecture notes</td>
<td>Email</td>
<td>Intranet</td>
</tr>
<tr>
<td></td>
<td>WWW</td>
<td></td>
<td>Internet</td>
</tr>
</tbody>
</table>

*Table 3.3. The University of Wollongong “Media Matrix” (CEDIR 2003).*
elements of Learning Management Systems are analogous to other non web-based technologies, that the technology selection methods for individual learning technologies can be generalised for use in the selection of technological elements of Learning Management Systems. The guides provided by institutions and organisations for the selection of technologies are generally helpful in the process of selection but limited as they tend to be prescriptive, are limited to currently available technologies and provide little insight into the nature of the technologies being selected hence limiting experimentation.

In Chapter Two the work of Laurillard (1993, 2002) in the classification of learning technologies and a “teaching strategy” were discussed. Laurillard takes a different approach to the selection of learning technologies which is worthy of investigation as her purpose is similar to that of this thesis, which is to develop a framework within which learning events may be designed which make appropriate use of learning technologies by matching them to learning activities. Laurillard develops her own “teaching strategy”, as described below and discounts the approaches taken in two major areas of enquiry. She argues that:

“Instructional design theory is logically principled, not empirically based, and therefore unable to build teaching on a knowledge of how students learn.” (Laurillard 2002, p 77).

Further, she discounts constructivist approaches as their focus is:
“… more on the teacher-student interaction … without offering a detailed link between teaching, student activity and interaction with the subject.” (Laurillard 2002, p 77)

Taking a phenomenographic approach, Laurillard develops what she refers to as: “the best expression of an empirically based teaching strategy so far” and states that it is an “iterative dialogue between the teacher and student focused on a topic goal” (Laurillard 2002, p 77). She then provides four aspects of the progression of the dialogue and details the responsibilities of the teacher and student in each. The aspects of teaching strategy are described as Discursive, Adaptive, Interactive and Reflective and are summarised in Table 3.4.

Laurillard then provides a classification system for learning technologies by classifying them by “media form” and discounts the work of many others who have classified media.

“There are many attempts in the literature to categorise and classify the forms of media, none of which is very illuminating or useful for our purpose here.” (Laurillard 2002, p 83)
Table 3.4. Aspects of Laurillard’s Teaching Strategy (Laurillard 2002, pp 77-78).

Expanding the categories in Table 3.4 Laurillard develops the theoretical basis of her work, which she calls a “Conversational Framework”.

“The framework against which we now evaluate the extent to which the various media support the full specification [of the teaching strategy]”. (Laurillard 2002, p 86)

The Conversational Framework lists twelve relationships between four components. The components are: the teacher’s conception and the student’s conceptions, the teacher’s constructed environment and the student’s actions. The twelve relationships are listed in Table 3.5.

1. Teacher can describe conception
2. Student can describe conception
3. Teacher can redescribe in light of student’s conception or action
4. Student can redescribe in light of teacher’s redescription or student’s action.
5. Teacher can adapt task goal in light of student’s description or action
6. Teacher can set task goal
7. Student can act to achieve task goal
8. Teacher can set up world to give intrinsic feedback on actions
9. Student can modify action in light of feedback on action
10. Student can adapt actions in the light of teacher’s description or student’s redescription
11. Student can reflect on interaction to modify redescriptions
12. Teacher can reflect on student’s action to modify redescription

Table 3.5. The Twelve Characteristics of Laurillard’s Conversational Framework (Laurillard 2002, p 105).

Laurillard states that there are five principal “media forms” and connects them to the learning experiences they support and the associated methods and technologies. These are reproduced in Table 3.6.

<table>
<thead>
<tr>
<th>Learning Experience</th>
<th>Methods/Technologies</th>
<th>Media Forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attending, apprehending</td>
<td>Print, TV, video, DVD</td>
<td>Narrative</td>
</tr>
<tr>
<td>Investigating, exploring</td>
<td>Library, CD, DVD, Web resources</td>
<td>Interactive</td>
</tr>
<tr>
<td>Discussing, debating</td>
<td>Seminar, online conference</td>
<td>Communicative</td>
</tr>
<tr>
<td>Experimenting, practising</td>
<td>Laboratory, field trip, simulation</td>
<td>Adaptive</td>
</tr>
<tr>
<td>Articulating, expressing</td>
<td>Essay, product, animation, model</td>
<td>productive</td>
</tr>
</tbody>
</table>

Table 3.6. Laurillard’s Five Principal Media Forms and Learning Experiences, Methods and Technologies (Laurillard 2002, p 90).

Laurillard then provides examples of learning technologies for each category of “media form” and provides an insight into their effective use in learning through a matrix that indicates which of the twelve activities
required by the “Conversational Framework” are supported by each example of learning technology.

While Laurillard’s approach appears to be conceptually strong, in practice its uptake has been limited, probably as to do so would require complete and systemic changes to institutional and individual teaching philosophies. Laurillard writes in the context of the United Kingdom Open University (UKOU), of which she holds the office of Deputy Vice-Chancellor. The UKOU is an extremely large university with enrolments in excess of 100,000 and hence has large resources for the design of learning events and the selection of technology. Laurillard’s framework, is clearly designed to be used as a complete package or systemic approach in which the design of learning events matches learning “strategies” to learning technologies and given the resources available at the UKOU, the adoption of it is quite feasible. However, it is difficult to address the question of adopting her framework in the context of smaller institutions or organisations where resources are limited. Laurillard’s framework is strategic and does not appear to translate to the work of individual designers in many smaller institutions and organisations, that is the selection of technology at the tactical level. If the technology selection section of her framework is isolated from the overarching framework it becomes cumbersome to the extent of impracticality. In practice the uptake of Laurillard’s framework has been limited, probably as at the strategic level institutions and organisations are reluctant to undertake a
systemic change to their teaching approach and at a tactical level individual designers apply their own approach or philosophy.

3.5. Criteria of Technology Selection.

The criteria by which learning technologies in Human Resource Development and in Higher Education are selected share some similarities across the various methods, models and lists. At the simplest level the costs of technologies are considered in all the selection methods surveyed in this chapter. Some researchers provide cost criteria in detail (Lee and Owens 2001), while others simply mention it in broad terms (Bates 1995, Rowntree 1994, Moore and Kearsley 1996). All the selection methods surveyed also consider criteria that are determined by the nature of the subject and those that have implications for the learners or the facilitator of learning. Several of the models surveyed separate these two groups of criteria while others consider them at the same time. For example Lee and Owens put “Content requires Interactivity (computer)” (Lee and Owens 2001, p 8) in the same category of criteria as “Students are resistant to new media” (Lee and Owens 2001, p 9), while Moore and Kearsley separate consideration of how well a learning technology will meet instructional objectives from identification of “student characteristics that will suggest or preclude” (Moore and Kearsley 1996, p 97) certain learning technologies.

The criteria by which learning technologies are selected in the methods surveyed in this chapter can be grouped as:
- cost
- nature of the subject
- implications for learners and facilitators of learning.

3.6. Conclusion.

In the last ten years the role of learning technology has changed significantly. In the contexts of Human Resource Development and Higher Education, Online Learning is providing increased opportunities and flexibility with the Internet providing a cheap and almost ubiquitous technology for the delivery and mediation of learning events.

The selection of learning technologies takes place on two levels in both the field of Human Resource Development and Higher Education. At the strategic level the decisions concern high-cost systems of technology that are generally organisation or institution wide. At the tactical level decisions are usually made by designers of learning events and generally concern which learning activities will be delivered or mediated by which learning technologies. The theoretical frameworks developed later in this thesis can be applied to both the strategic and tactical decision making levels.

The literature concerning the selection of technology for learning in Higher Education and Human Resource Development is characterised by case studies and appears to be undertheorised as it presents little in the way of generalisation of individual experiences to the field as a whole. This
contrasts markedly with the selection of technologies for Organisational Communications in which not only theories, but families of theories have been developed. While Organisational Communications might appear outside the scope of this thesis, a discussion of the central theories developed in this area has been included as a comparison to the relative lack of theorisation in the other areas and as they will be used in the development of the theoretical framework for learning technologies in Chapter Six. The methods and guides for the selection of learning technologies located in the literature are not suited to the selection of learning technologies by individual designers of learning events for a number of reasons. Some methods have been developed for use in classroom teaching where technologies are adjuncts to the teacher’s presentation and hence they are not suited to the selection of technologies that are central to the process of learning. Some methods or guides have been developed in the context of large organisations or institutions where resource levels are such that Instructional Designers will bring their specialised, technology selection skills to the design team. Other methods or guides are prescriptive and propose a limited number of technologies from which the designer selects. While this approach might be effective it does not actively encourage the designer to use the technologies in new and different ways. As well many guides or methods of this type do not readily or easily expand to include new technologies and hence quickly become obsolete.
Researchers and designers of learning events require theoretical frameworks of learning activities and theoretical frameworks of learning technologies if they are to gain an understanding of the application of learning technologies. Designers working by themselves who are often facilitators of the learning events they design, require a technology selection method that matches learning technologies to learning activities in an appropriate manner that provides the designer with an understanding of the nature of the technology, does not prescribe technologies and can easily expand to include new technologies.
Chapter 4

Gaps in Existing Theories of Learning
Technologies, Learning Activities and
Methods of Technology Selection.

4.1. Introduction.
In the 1990s flexibility of where and when learning took place, grew in significance to learners and providers of learning. Managers of Higher Education saw flexibility as a way to increase participation rates without a concomitant increase in resources and staff. In Human Resource Development flexibility meant that learners could learn when it suited the organisation or the task and hence maximise performance gains. In both contexts, flexibility of the time and place of learning was seen a way to increases in efficiency and effectiveness.

Flexibility in learning is generally characterised by the use of Information and Communication Technologies (ICTs) for the provision of learning
materials and for the mediation of interactions between learners and between learners and facilitators and it follows that the design of flexible learning entails the selection of Information and Communications Technologies or learning technologies.

The selection of learning technologies in the contexts of Higher Education and Human Resource Development occurs at two levels: the strategic and the tactical. At the strategic level an institution or organisation may decide to invest in a high-cost technological system such as Learning Management Systems or videoconference. At the tactical level, personnel responsible for the design of learning events will match technologies, or elements of them, to learning activities. To do so in a manner that is appropriate to the learners, the material, the context and the budget, designers of learning events need a theoretical framework of learning technologies, a theoretical framework of learning materials and a technology selection method that matches technologies to activities using the frameworks. This thesis provides these frameworks and method. The literature on learning technologies, learning activities and technology selection in the contexts of Higher Education and Human Resource Development has been investigated to ascertain the suitability of theoretical frameworks in these areas to the purpose of technology selection. Unfortunately, while rich in case studies this literature is undertheorised. As discussed in Chapters Two and Three, attempts have been made to categorise and classify learning technologies with the intention of
providing guidelines, methods and models for the selection of learning technologies. However, the attempts are not suitable for the purpose of this thesis for the following reasons. The older of the attempts have little relevance to contemporary learning event design as the technologies they were designed for have been superseded or newer technologies are now used in parallel with them. Some attempts have little to offer the designer of learning events as they appear to state the obvious by classifying technologies by their characteristics. For example, Leshin, Pollock and Reigeluth classify learning technologies as “human, print, visual, audio/visual or computer-based” (Leshin et al 1992, p 256). Other attempts categorise technologies by the learning functions they serve. For example Laurillard (2002) develops a “teaching strategy” and divides it into several sections. She then categorises learning technologies into equivalent categories and hence describes the suitability of individual technologies to the sections of her teaching strategy. While Laurillard’s approach appears to be conceptually strong, in practice its uptake has been limited, as to do so would require systemic changes to institutional and individual teaching approaches and the adoption of her “conversational framework” and hence have little to offer the designer at the tactical level of technology selection.

As the design of learning that uses technology in a central role concerns the matching of technologies to learning activities, the literature of learning activities was reviewed to determine the suitability of classification systems of learning activities to this purpose. Unfortunately little has been
written about learning activities and much of what has been written is not suited to technology selection, as it is intended for other purposes, in particular the design of classroom-based teaching. The few attempts that consider learning activities in the design of technologically rich learning events are generally confined to lists and examples. However, a closer examination of the literature on learning technology provides a number of examples of tacit classifications of learning activities. For example, Rowntree (1994), Bates (1995) and Taylor (2001) all indicate in their descriptions of learning technologies a differentiation between one-way and two-way technologies. It is not difficult then to infer that learning activities can be categorised as:

- one-way, or interactions with materials, and
- two-way, or interactions between people

and this is often reflected in many learning experiences. While this tacit categorisation of learning activities does not provide sufficient conceptual detail for it to be useful in detailed selection of learning technologies at the tactical level it is a starting point for a theoretical framework of learning activities.

The literature contains several tools for the selection of learning technologies in Human Resource Development and Higher Education. Unfortunately many of these tools are superficial or undertheorised and hence have limited applicability to learning event design. For example, many of the tools are lists of factors to be considered or matrices that prescribe technologies. In sharp contrast, the related field of
Organisational Communications contains a well-theorised literature on technology selection. Although the reasons for the selection of technology are slightly different, one of the theoretical approaches has been adapted for use in the development of the original theoretical framework of learning technologies presented in this thesis.

As mentioned earlier, one purpose of this thesis is to develop a conceptually rich method for the selection of learning technologies that is appropriate to the learners, the material, the context and the budget. To do this at a tactical level, learning technologies must be matched to learning activities and hence sound theoretical frameworks of learning activities and learning technologies are the foundations upon which a solid technology selection method can be built. The literature provides some key elements which provide the starting points for the theoretical frameworks of learning activities and learning technologies.

4.2. Key Elements in the Literature.

Of the points in the literature concerning learning technologies, one key point provides the notion that forms the basis of the theoretical frameworks developed in this thesis. As mentioned earlier, learning technologies have been categorised as one-way or two-way. One-way technologies have been described as those with which learners interact with materials and two-way those with which learners interact with other humans. As there appears to be agreement between several commentators, and as the division of technologies into one-way and two-way is congruent with the
author’s experience it is used as the formative basis of a theoretical framework of learning technologies.

Where learning technologies are central to the process of learning, for example in Online Learning, they can be used to provide a categorisation of the learning activities they facilitate. As technologies can be categorised as those that provide and facilitate interaction with materials and those that facilitate interaction with other humans, so learning activities can be categorised as interactions with materials and interactions between people. In this thesis, this categorisation is expanded to provide the basis of the theoretical framework of learning activities.

Another key element that emerges from the literature concerns the criteria used in existing methods of technology selection. While the literature contains many different lists and methods of technology selection, the individual criteria from the lists and methods can be easily categorised into:

- Cost factors
- Factors determined by the nature of the subject, and
- Implications for learners and facilitators of learning.

Another key element from the literature forms part of the basis of the original theoretical framework of learning technologies. Drawn from the literature of Organisational Communications, this key element is the basis of the family of trait theories of technology selection. The trait theories
categorise technologies by their traits, or communications channels available and ranks different technologies by this criterion. Although the trait theories have been superseded by later theories that are more germane to the area of Organisational Communications, the ranking of technologies by traits provides a comparative understanding of the technologies and has the potential to be part of a theoretical framework.


Several systems of classification and categorisation of learning technologies were investigated for their suitability to the technology selection process. Several commentators have provided frameworks for the classification of technologies, none of which are suitable for the purpose of this thesis. Several of the classification systems simply group technologies by their characteristics (Leshin, Pollock and Reigeluth 1992), which adds little to user’s understanding of them. Others provide superficial classifications, for example one-way and two-way, which while being sound starting points for understanding, are not suitable for the purpose of this thesis due to a lack of development upon that basis (Bates 1995, Rowntree 1994, Taylor 2001). Laurillard (2002) proposes a classification system in which learning technologies are grouped into five “media forms”. Unfortunately this system of classification provides little help in the selection of technologies unless it is used in conjunction with her “teaching strategy” and as this would require changes in teaching philosophy at a strategic or institutional level the use of her system has
been limited and the media forms are not relevant to designers of learning events making tactical, learning technology decisions.

4.4. The Gap in Theoretical Frameworks of Learning Activities.

As mentioned earlier, part the process of the design of learning events that use technologies in central roles is the matching of learning activities to learning technologies. An appropriate theoretical framework of learning activities would provide designers with a conceptual tool and assist in the matching process.

The literature of learning activities is small, and generally not suited to the purpose of this thesis as the theorisation is often for different purposes. For example, Gagné, Biggs and Wager (1992) divide learning activities into chronological categories for classroom teaching and this thesis is concerned with the design of learning that will generally not take place solely in a classroom. Other classifications of learning activities in the literature have limited application to the design of technology-based learning. Some commentators provide lists of activities and suggest that the design process is simply one of selection from it (Wilson 1999). This approach has obvious shortcomings that severely limit its application to the design process. As it is prescriptive, learning designers are not provided with an understanding of the technologies involved and hence extension of them beyond the prescribed activity is not encouraged. As well the list is constrained to the technologies available at the time of its
Chapter 4. Gaps in Existing Theories of Learning Technologies, Learning Activities and Methods of Technology Selection.

compilation, which in a world of rapid technological change is a limiting characteristic.


The literature on the selection of learning technologies in Higher Education and Human Resource Development is characterised by case studies and is markedly less theorised that the literature of the selection of technologies for Organisational Communications within the field of Management. One of the theoretical approaches developed for technology selection in the field of Organisational Communications is used as part of the basis for the theoretical framework of learning technologies developed in this thesis. The Higher Education and Human Resource Development literature contains several technology selection methods that are well theorised but are not useful to the purposes of this thesis as they have been developed for use in contexts where technology is an adjunct to the “teacher in a classroom”, face-to-face learning approach, or they do not include recently developed technologies such as the Internet and World Wide Web. The literature on Distance Education provides a number of technology selection methods for the strategic and tactical levels. The technology selection methods aimed at the strategic level are clearly differentiated from those intended at the tactical level, as they generally concern high-cost, institution-wide systems of technology and are often presented within managerial contexts such as cost-scale, cost-benefit analyses and other institution-wide issues. The recent literature on technology in learning is concerned in large part with web-based
technologies and in particular Learning Management Systems. As with the earlier literature, it is characterised by case studies and a lack of generalisation that can lead to a theoretical approach to technology selection. In several places guides have been produced to assist designers at the tactical level in the selection of technologies, or technological elements of a Learning Management System. These guides to technology selection at the tactical level are prescriptive, do not extend to include new technologies when they become available and as mentioned earlier are undertheorised.

To select learning technologies at the tactical level in a way that provides a considerable degree of confidence in the appropriateness of the selection for the learners, the material, the context and the budget, a robust theoretical framework is required which has the following characteristics:

- it must be sufficiently flexible to operate within institutional or organisational approaches to, or philosophies of education
- it must be easily generalised across disciplines and for other technologies
- it must provide designers with an insight into the characteristics and nature of the technologies they are selecting and hence lead to individual decisions that are not general, simple and prescriptive
- It must lead to decisions that are adapted to the learners, material, context and budget of each case

This thesis addresses the deficiencies in existing conceptualisations of learning technologies and learning activities by the development of two new theoretical frameworks and a practical method. A theoretical framework of learning activities, entitled Learning Activities Model (LAM), categorises learning activities based on the notion that the activities of the process of learning can be described as the provision of materials and interactions. The second theoretical framework categorises and classifies learning technologies. Entitled, The learning Technologies Model (LTM) this framework has two dimensions. In the first dimension technologies are classified as one-way, for the provision of materials or two-way for interactions between humans. In the second dimension technologies are classified by the communications cues that they support. The theoretical frameworks are then brought together to form an original method for the selection of learning technologies. This Technology Selection Method (TSM) is based on matching technologies as analysed by the Learning Technologies Model to categories of the Learning Activities Model. A four-step process is suggested in which technology options are narrowed.
Chapter 5

A New Learning Activities Model.

5.1. Introduction.

The effects of Open, Distance and Flexible Learning, and the changed role of technology in learning have been felt in almost all educational institutions. Technology in many subjects now plays a central role and Learning Management Systems are becoming part of the standard software of Higher Education institutions. However the influence of learning technology has not been limited to education. The literature on Human Resource Management (HRM) recognises that there are benefits to be gained through the application of some of the techniques and technologies of Flexible Learning to training and development (Smith 1992, Wilson 1999). As mentioned in Chapter One the term “Flexible Learning” is used in this thesis to refer collectively to the approaches of Open, Distance and Flexible Learning and to the literature that is concerned with them.

The literature on Flexible Learning has been shown to support the notion that the process of learning can be described as consisting of the
provision of materials and interactions. In Chapter Two, the literature was interpreted as providing tacit conceptualisations of the process of learning as provided materials and interactions. In this chapter, this description is defined, described in greater depth and interaction is also subdivided into several categories. The categories of interaction and the provision of materials are then brought together to constitute the new Learning Activities Model (LAM).

This model is the first of two theoretical frameworks developed in this thesis and provides the field with a new analytical tool and as well as informing the learning technology field, is intended to assist designers of learning events by arguing that categories of activities, that are subdivisions of the learning process can be matched to techniques, technologies and methods in the design process. While the literature, in many places (Bates 1995, 2000, Taylor 1997, 2001), implies that the process of learning can be described as interactions and delivered things, previous investigators have chosen not to use these categories of learning activities as overt tools for the analysis of the learning process. The research reported here conceptualises learning activities and presents a theoretical framework within which the process of all learning events can be described and analysed. This framework is the Learning Activities Model (LAM). When the selection of learning technologies is addressed in Chapter Seven, the categories of activities form identifiable elements to which appropriate technologies can be matched. This chapter concludes
with several examples, which analyse fictitious learning events, and illustrate how the model can describe the learning process.

5.2. Provision of Material.

Traditionally, the predominant approach to undergraduate university teaching consisted of a presentational style. Most lectures were primarily concerned with the provision of material, as learning seemed to be equated with the acquisition of knowledge as opposed to the development or construction of it by students. A similar approach occurred in Human Resource Development and many programs have been conducted in venues where a trainer presents material to a group of trainees. The material was provided by the words the lecturer or trainer spoke and the words written on the board, overhead projector, screen or handout. The material provided in traditional presentations like this resulted in the notes and memories that learners took away from the training room or lecture theatre.

In Flexible Learning, the provision of material is usually by different means. It may be provided in the form of printed materials or by other technologies. In this thesis the term “material” is used for several reasons, firstly to differentiate between human and non-human resources. In a face-to-face presentation “material” is provided by the presenter to the audience as opposed to the human resource that is the presenter. The difference becomes clear in technology-based learning events, where learners interact with a recording of the presenter, or materials rather than
the presenter themselves or the resource. The primary difference between
the two is the nature of the interactions. In face-to-face cases learners
can interact with the presenter while in the case of the recording learners
are limited to interacting with the material. Of course, in Flexible Learning
there are other channels that are often used for interaction with the
presenter however, these generally constitute a separate technological
channel to that used for the provision of materials. Chapter Six provides
further clarification of this differentiation in the discussion of the Learning
Technologies Model (LTM).

The term “material” has been selected to describe what is provided. This
term is preferred to “knowledge”, “information” or “data” as it reinforces the
notion that the materials themselves are passive, inert and do not
constitute learning until learners do something with them. The term,
“knowledge” is not used, as knowledge is generally considered to be one
of the possible outcomes of learning. For example, the work of Bloom,
Krathwol and others refers to the outcomes of learning as consisting of
skills, knowledge and attitudes (Gronlund 1978) while Gagné, Biggs and
Wager (1992) list the outcomes as:

- intellectual skills (or procedural knowledge);
- cognitive strategies;
- verbal information (or declarative knowledge);
- attitudes and
- motor skills” (Gagné et al 1992, p 13).
Another reason for referring to what is provided as “material” is to highlight the difference between data, information and material. The term; “information” implies an interaction, or the process of informing someone or something. The meaning of “data” is restricted as they are often thought of as simply numbers. In this thesis the term “material” is used to clearly indicate the words, pictures, sounds and other things that form part of the learning event.

The first category of the Learning Activities Model (LAM) consists of activities concerned with the provision of material and is referred to as “Provision of Materials”. Materials may be provided in the classroom, training room or lecture theatre where they are part of the learning process. Alternatively, in Flexible Learning, materials may be provided away from designated learning venues. Materials can be provided in a number of ways, including:

- the voice of the presenter or facilitator in a training program, lecture, tutorial, seminar, laboratory, study group, residential school,
- visual aids to the above,
- printed materials - for example, prescribed texts, references and manuals,
- other printed materials such as training notes study guides, lecture notes, handouts, and
Chapter 5. A New Learning Activities Model.

- other media - for example, radio and television programs, audio and video, internet resources, web pages, multimedia.

5.3. Interactions.

The provision of material alone is generally not considered sufficient to produce the desired outcomes of a learning event. For learning from materials to occur learners have to interact with it and, clearly, in many learning events other types of interactions occur. These other interactions can be identified through the analysis of Distance Learning and Flexible Learning as practiced in Higher Education and Human Resource Development (HRD) in general and specifically in the following example.

Correspondence courses represent one of the earliest forms of Distance Learning. In correspondence courses, learners interacted with printed materials that were sent to them through the mail. Sometimes there was opportunity for limited interaction with the facilitator in the form of comments and corrections on assignments and assessments. Usually there were few, if any, opportunities for interaction between learners. When technology was added to correspondence courses, and the term “Distance Learning” (or “Distance Education”) applied to it, there was greater opportunity for interaction between learners. However, in many cases this was limited due to the high cost of conferencing technology or other communication technology.
Distance Learning presents a clear comparison to face-to-face learning where there usually are many opportunities for learners to interact with facilitators and with other learners. From the above general comparison between Distance Learning and face-to-face learning, three discrete categories of interaction can be identified. They are:

- Interaction with materials,
- Interaction with the facilitator, and
- Interaction between learners.

As the terms ‘interactive”, “interaction” and “interactivity” are used widely and applied in many fields and places, they need to be clarified. The Oxford English Dictionary (1992) defines “interaction” as "Reciprocal action; action or influence of persons or things on each other" and interactive as:

1. Reciprocally active; acting upon or influencing each other
2. Pertaining to or being a computer or other electronic device that allows a two-way flow of information between it and a user responding immediately to the latter's input”

In this thesis the term “interaction” is used in preference to “interactive” or interactivity. Apart from the grammatical constraints, this is done to avoid confusion that can occur with the term “interactive”. “Interaction” in several dictionaries is defined as action on each party or reciprocal action. There are usually two definitions of “interactive”, one that describes things
that interact and another that describes computers that react immediately to the input or commands of the operator. So that there is no confusion between what is meant here by interactive and the computer definition of interactive the use of interaction is retained, and defined as reciprocal action. This is broader than, but includes, the interactivity of computer programs. For example a conversation in which each party tries to change the attitude of the other can be described as interaction. To further clarify the concept of interaction in learning it is compared to the provision of material that was mentioned earlier. The provision of material can be seen as a one-way process as when learners interact with it material flows from the providing technology or person to the learner and usually not the other way, that is, from the learner to the technology or person. However, interaction is essentially two-way process allowing information to flow back and forth between learners, facilitators and other people or things. For example, when a learner (or for that matter any viewer) watches a broadcast of a television program, material is provided to them. If they make a video recording of the program and replay it, pause, rewind and replay parts of it, the process gains an aspect of the two-way, and to a limited degree they interact with it.

The three categories of interaction are clearly identifiable in learning although not all categories are present in all learning events. The first category of interaction, and the second category in the Learning Activity Model (LAM), is Interaction with Materials.
5.3.1. Interaction with Materials.

As well as the different categories of interaction that can be identified in learning events there are different levels of interaction that can be present within each category. Obviously there are many levels and styles of interaction and although the interaction of the learner or viewer in the example of the videotape (above) is rather basic, it could serve to help achieve the desired learning outcomes through the removal of the ephemeral characteristic of the broadcast once the program is encapsulated in a video recording. “Interaction with Materials” is the second category in the Learning Activities Model (LAM) and some examples of activities in this category include:

- looking up a definition in a reference book
- pausing, rewinding and replaying sections of a video or audio recording
- searching the Internet or World Wide Web
- interacting with computer aided learning packages. eg multimedia

In face-to-face learning, the boundary between the provision of material and interaction with it can be difficult to distinguish. In a presentation, material is provided by the voice of the presenter and by any visual aids used. By definition interaction with the material only happens when a learner does something with it. In Flexible Learning the boundary between provided material and interaction with it, is usually clearer than in traditional face-to-face learning. Often the material is recorded and
provided by a technology and in such cases the boundary is defined by the boundary of the technology.

### 5.3.2. Interaction with the Facilitator.

Interaction with the teacher or trainer plays an important role in many learning events and for simplicity’s sake this person is referred to in this thesis as the “facilitator”, as mentioned in Chapter One. The role of the facilitator in traditional face-to-face learning will be different to their role in Flexible Learning. In Flexible Learning the role can include some or all of the following:

- design of materials,
- consultation with learners,
- assessment of learners’ work,
- answering learners’ questions, and
- provision of materials.

In some contexts, for example in-house training in a small company, these activities might be undertaken by one person. In traditional face-to-face learning at a university it could be a team consisting of a lecturer, a coordinator and one or more tutors. In Flexible Learning, learning events can be the result of single or team efforts. The teams can consist of academics who provide the content material, tutorial staff who answer learners’ questions and assess their work, as well as Instructional Designers, administration and other infrastructural staff.
In a face-to-face learning environment, learners interact with facilitators by interjecting in a presentation or asking questions during a consultation with the facilitator in their office or elsewhere. An example of interaction with the facilitator in Higher Education can be a discussion taking place between a teacher and student in a tutorial or seminar. An example of interaction with the facilitator in training could be the discussion between a participant and the trainer in an in-service workshop. Tutorials, consultations and workshops traditionally have been face-to-face meetings, however, interaction with the facilitator can happen in Flexible Learning through the use of technologies like electronic mail, audio conferencing, videoconferencing and Online Discussion. While face-to-face interaction is obviously synchronous, the technologies used for interaction may be either synchronous or asynchronous. Some examples of the techniques and technologies that can be used in interactions with the facilitator are:

- questions and answers in lectures,
- questions and answers in workshops,
- tutorial discussion,
- phone calls,
- email,
- letters,
- facilitator/learner consultation (face-to-face),
- audio or video conference discussions,
- feedback on assessments, and
- chance meeting and social events.
Generally interaction is a valued quality of learning. The author was a member of the Education Committee of the National Tertiary Education Union (NTEU), the peak academic industrial union in Australia, which developed a policy statement that echoes this sentiment.

“NTEU recognises the increase of flexible teaching and learning in tertiary education and while the benefits of flexible teaching and learning are also recognised it must be remembered that education is an interactive process, at the heart of which lies the relationship between student and teacher.” (National Tertiary Education Union 1997, p 12)

In many Australian universities, it is part of teachers’ duty statements to be available for a number of hours per week for student consultation. Also many teachers cultivate an attitude of questioning in their students, hence engendering a learning style that is highly interactive. In Human Resource Development (HRD) interaction is also valued and considered vital to learning.

“All collaborative learning theory contends that human interaction is a vital ingredient of human learning.” (Kruse and Keil 2000, p 22)

Interacting with the teacher, trainer or facilitator is the third category of the Learning Activities Model (LAM) and is referred to as “Interaction with Facilitator”. The third type of interaction and the fourth category of the
Learning Activities Model (LAM) is interaction between students, trainees or participants and is referred to as “Interaction between Learners”.

5.3.3. Interaction Between Learners.

Interaction between learners can be formal or informal. The most formal would be in events such as student presentations in tutorials or participant interaction in workshops. Other examples of formal interaction between learners occur where they work as a group or team on a project for assessment. Less formal interaction between learners can occur at any time or place where they talk about their learning.

These last two categories, (that is interaction with the facilitator and interaction between learners) are both dialogic. Dialogue can have different attributes depending on the technology it is mediated by. For example email is generally limited to text while a videoconference can include body language and vocal attributes. Dialogue here is defined as a conversation and is not limited to a duologue. The nature of dialogue is expanded further in Chapter Six within the context of the second theoretical framework presented in this thesis, which is the Learning Technologies Model (LTM).

5.3.4. The Fifth Category of Learning Activities.

The first four categories of the Learning Activities Model describe the learning process as consisting of Provided Materials, Interactions with Materials, Interactions with the Facilitator and Interactions between
Chapter 5. A New Learning Activities Model.

Learners. This is not a complete description of all learning activities, rather it is a description of the activities that can be planned and undertaken in order to facilitate learning. There are a number of things that learners do in order to learn or as part of the learning process that the designer of the learning event can facilitate but generally cannot control. These activities do not fit into the first four categories of the Learning Activities Model and include activities such as:

- learners’ informal reflection on what they have heard or read,
- formal or structured reflective practice,
- critical thinking,
- refining ideas, opinions and attitudes,
- comparing new to existing knowledge and experiences
- structured or directed reflection, and
- ‘the penny dropping’ or sudden realisations that are apparently not stimulated.

As these activities are outside of the categories mentioned so far, and so that the model can represent all learning activities, a category for these activities is added to the Learning Activities Model. This is the fifth category and is referred to as “Intra-action”, a term coined by the author to describe action within. Intra-action as a category of activities is worthy of investigation. However, such an investigation, while helpful to understanding learning, is outside the scope of this thesis.

The five categories of learning activities combine to form a theoretical framework or model of the activities in the process of learning. While the
first four categories of learning activities can be determined in the design process, Intra-action is very difficult, if not impossible, to ensure. The opportunities for Intra-action can be maximised through thorough and appropriate design of the learning activities, and environment. However, as learners bring their own psychological baggage to their learning and as it is ultimately dependent on them, Intra-action cannot be prescribed or guaranteed.

5.4. The Learning Activities Model.

The five categories described are brought together to form the Learning Activities Model (LAM). This model is a theoretical framework of learning activities and is the first theoretical framework presented in this thesis. It has theoretical and practical applications and is represented graphically in Figure 5.1.

![Figure 5.1. Graphical Representation of the Learning Activities Model.](image)

In Figure 5.1 the space enclosed by the circle represents the total of all activities that happen during the process of learning and can be applied to complete programs of structured learning in a range of granularity. At the most granular level the model can be used to analyse or describe the
approach taken to learning by an institution or organisation and the activities listed for each category of the model would reflect the approach. At a finer level of granularity the model can be applied to courses or programs or to subjects or modules of a program or subject as illustrated in the example in Appendix Two. At the finest level of granularity the model can be applied to short discrete learning events such as using a set of instructions to perform a task. The five categories of the model; Provision of Materials, Interaction with Materials, Interaction with the Facilitator, Interaction between Learners and Intra-action are indicated by the segments or “piece of pie” shapes.

It is not suggested that all categories of the model need to be present for learning to occur or that there is a relationship that always correlates the presence of more elements with increases in the effectiveness and efficiency of learning. Some successful learning events may use all five categories, and others may use only two or three. There are many factors to be considered in the design of the number of categories of the model to include in learning events. For example while interaction between learners is generally considered desirable in learning events it may be reduced or not occur where the number of learners is small, the duration of the learning event is short and flexibility of time is desired. In such cases it would be conceivable for no interaction between learners to occur during the process of learning.
Chapter 5. A New Learning Activities Model.

The model is proposed as a theoretical framework for the analysis of planned or existing learning events. It also provides a framework within which the activities of learning events can be mapped and as a tool for the design of future learning events. The following examples are provided to illustrate the model in general terms and to demonstrate the applicability of the model to commonplace learning environments.

5.5. The Model Exemplified.

This group of examples concerns a simple, everyday learning event: preparing and cooking food from a recipe for the first time. The desired learning outcome can be easily, although subjectively, measured as the successful production of the food. The first example is the simplest, containing only two categories of learning activities. In subsequent examples further categories of the model are added expanding and developing the activities of learning. In the simplest case of the example, the learner is the person preparing the food and they interact with the learning materials. In this case the learning materials are the recipe and other relevant information, for example a conversion chart for weights and measures. We all know that food can be prepared this way and that the results can be anywhere in the spectrum of taste. So it would be reasonable to suggest that effective learning can happen this way.

5.5.1. Example 1.

The materials are already on hand and not provided as part of the learning event. The facilitator (assuming the facilitator is the person who prepared
the recipe and instructions) is not present and the learner works by themselves. The activities are:

- interaction with the materials (the materials being the recipe book, not the ingredients) and
- intra-action (where the intra-action is the comparing and critical evaluation of the process with recipes prepared earlier and other experiences).

This is represented graphically in Figure 5.2.

![Figure 5.2. Example 1. Interaction with Materials and Intra-action.](image)

### 5.5.2. Example 2.

In the second example the learner prepares the food in much the same way but this time the materials include a videotape of television program, and through the recorded program activities in the category of Provision of Material are introduced. As well as interacting with the recipe some limited interaction with the videotape (ie replaying, pausing, etc) is possible as well. The graphical representation (Figure 5.3) is the same as in the earlier example with the addition of the Provision of Material category.
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5.5.3. Example 3.

In the third example the learner prepares the food in much the same way interacting with the materials including the television program. However, the learner is not alone. They work and interact with another learner, discussing aspects of the food preparation, sharing information, experiences, knowledge and reactions. Hence the category of Interaction between Learners is added and the graphical representation is presented in Figure 5.4.

Figure 5.3. Example 2. Provision of Materials, Interaction with Materials and Intra-action.

Figure 5.4. Example 3. Provision of Material, Interaction with Material, Interaction between Learners and Intra-action.
5.5.4. Example 4.

In the fourth example, the learner is a member of a face-to-face cooking class. They still interact with the materials and the other learners, and material is provided by the words spoken by the facilitator. The category of Interaction with the Facilitator is introduced as opportunities exist for learners to question and interact with the facilitator. In this example, all five categories of learning activities are present.

![Figure 5.5. Example 4. All Categories.]

The examples of the cooking class show how the model can be used to analyse existing learning events in a general everyday learning environment. The category, Intra-action has been included in each example and as mentioned earlier this category is one that the learner controls rather than the facilitator or designer and is included here as an indication that it is possible for activities in this category to take place in these examples.

As the context for the research described in this thesis is not a cooking class but rather learning in Human Resource Development and in Higher Education, the following fictitious examples are provided to clearly describe the application of the Learning Activities Model. The examples
and the accompanying analysis of each category of activities within them, provide a guide to the application of the model to other learning events. The examples are in two groups: Higher Education, and Human Resource Development.

5.6. Higher Education Examples.

The first group of examples provides three comparative analyses of learning events that are common in Higher Education. Large lectures are compared to small lectures. Tutorials are compared to seminars, and traditional teaching is compared to Flexible Learning.

For literally hundreds of years, lectures have been used as one of the major learning activities in universities. They have certainly ranged in quality from being dull, boring and poorly delivered to well presented, engaging and exciting, and likewise their effectiveness and efficiency as learning events has ranged just as widely. Lectures have been presented to audiences of varying sizes. Ranging from first year core subjects in large universities with hundreds of students to small groups studying esoteric post-graduate subjects. The presentation styles and learning activities afforded vary significantly along the range of lecture size and it is clearly not practical to analyse examples of every different lecture size here. Two typical examples are provided in which the Learning Activities Model is applied to a large lecture and a small lecture.
5.6.1. Large and Small Lectures.

Usually in large lectures the range of learning activities that is practicable is limited and in many large lectures the most obvious learning activities consist of the lecturer speaking to the group and using audio/visual aids. The words, vocal attributes and body language of the lecturer plus the words, sounds and pictures in the audio/visual material comprise the things that are transmitted or provided by the lecturer. In terms of the Learning Activities Model these activities are in the category of the Provision of Material. As was mentioned earlier, it is not suggested that this alone is sufficient to engender the desired learning outcomes. Learners need to interact with the provided material and to undertake activities in the interaction categories for learning to occur.

While many teachers would not hesitate to answer questions during a lecture, interaction with the lecturer in large lectures is usually limited to those learners who have the ability, motivation and/or confidence to ask. Of course learners do benefit from hearing their colleagues’ questions answered but interaction with the lecturer is often limited by the large physical size of the group. So in terms of the Learning Activities Model, activities in the category of Interaction with the Facilitator (in this case the lecturer) are limited.

In a lecture to a large group of learners (for example, one hundred or more) the management of group activities becomes difficult or impossible. Hence in terms of the Learning Activities Model, activities in the category
of Interaction between Learners are limited and often do not exist in practice. A lecture that engages a large group of learners, that is well presented and makes appropriate use of well designed audio/visual materials, can provide opportunities that allow for interaction with the material presented, but it is generally limited to the notes learners take or in new or changed attitudes or ways of thinking about an idea, concept or issue. In terms of the Learning Activities Model, in a large lecture, activities in the category of Interaction with Material are thus limited.

In analysing a typical large lecture in which the lecturer presents and the audience is passive, it can be seen that opportunities for activities in the categories:

- Interaction with the Facilitator (in this case the lecturer),
- Interaction with the Materials, and
- Interaction between Learners,

are limited due to the physical size of the audience and the concomitant lack of practicability. Conversely, large lectures can provide opportunities for efficient and effective activities in the Provision of Material category.

In small lectures, where the lecturer has more control over the mechanics and physical arrangement of the learners, a greater range of activities is practicable. As in large lectures, the typical learning activities of the lecturer speaking to the group and using audio/visual materials can provide an efficient and effective way to provide material. However, if the
numbers of learners are small enough, group or individual activities can
easily be structured as part of the lecture, which provide opportunities for
Interaction with the Facilitator (in this case the lecturer) and Interaction
between Learners. In terms of Learning Activities Model, this would
increase the activities in these two categories.

The analyses of large and small lectures can now compared for each of
the categories of the Learning Activities Model as shown in Table 5.1.
Intra-action is possible in large and small lecture but, as mentioned earlier,
it is dependent on learners and cannot be prescribed by the facilitator or
designer of the learning event. Intra-action is included in Table 5.1 to
indicate that it is possible but not inevitable.

It is tempting to compare small lectures with large lectures, as analysed by
the Learning Activities Model, and arrive at the conclusion that in all cases
small lectures would be better at achieving the desired learning outcomes.
While this may be so, such a conclusion is specious as there can be many
other factors that need to be considered. These can include the suitability
of the material to the various activities as well as the efficiency of a large
lecture. In cases where the desired learning outcome is the transmission
of information and the student numbers are great, a well-presented large
lecture can provide the outcomes in an efficient and effective manner.
Table 5.1. Learning Activities Model: Analysis of Large and Small Lectures.

5.6.2. Tutorials and Seminars.

Other traditional learning events that are commonplace in Higher Education are tutorials and seminars. For this thesis, a tutorial is described as a meeting of learners and facilitator (in this case the facilitator is the tutor or a lecturer) where problems are discussed and/or solved. Group and individual work can be undertaken. Seminars are described as presentations by a learner (or small group of learners) to a larger group of their peers followed by a discussion. Both the presentation and discussion would normally be in the presence of a facilitator (in this case a tutor or lecturer).
In tutorials, as described above, there are opportunities for activities in the categories Interaction with Material, Interaction with the Facilitator and Interaction between Learners. There are also opportunities for Intra-action. In this type of tutorial, the provision of material is usually restricted. Examples of activities in the Interaction with Material category in tutorials include: things learners look up in texts, references or notes and the occasional reinforcement of a point by the facilitator.

The provision of material in a presentation by learner(s) is a central part of a seminar. Presentations are generally followed by discussions between the presenter, the other learners and the facilitator. Some material can be provided by the presentation and learners interact with the material presented in order to contribute to the ensuing discussion. The discussion provides opportunities for interaction between learners and interaction with the facilitator, who in this case would typically be a lecturer or tutor.

The analyses of seminars and tutorials can now be compared by each of the categories of the Learning Activities Model and is represented in Table 5.2. Intra-action is possible in seminars and tutorials but, as mentioned earlier, as it is predominantly dependent on learners, the facilitator or designer of the learning event cannot prescribe it. The category Intra-action is included in Table 5.2 to indicate that it is possible but not inevitable.
Chapter 5. A New Learning Activities Model.

<table>
<thead>
<tr>
<th>Category</th>
<th>Tutorial</th>
<th>Seminar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of Material</td>
<td>Limited</td>
<td>Student presentation</td>
</tr>
<tr>
<td>Interaction with Material</td>
<td>Limited</td>
<td>Limited</td>
</tr>
<tr>
<td>Interaction with Facilitator</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Interaction between Learners</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Intra-action</td>
<td>possible</td>
<td>Possible</td>
</tr>
</tbody>
</table>

Table 5.2. Learning Activities Model Analysis of Tutorials and Seminars.

As with the comparison between large and small lectures, it would be inappropriate to assume that seminars are more efficient or more effective learning events when compared to tutorials simply because more elements of the model are present. Rather, this analysis highlights the different nature of the learning events. As well it draws attention to the differences in the characteristics and nature of these learning events which can inform the design process and result in more effective and efficient learning events.

The use of the Learning Activities Model (LAM) in the analysis of learning events in Higher Education serves a number of purposes. Later in this thesis the LAM will be used as part of the proposed Technology Selection Method. As well the LAM can be used to analyse learning events. For
example, the above analyses of learning events in higher education (small and large lectures, tutorials and seminars) serve to remind the facilitator (or designer of learning events) that there are strengths and weaknesses in each and that when these are matched to:

- the needs of the learners,
- the requirements of the content,
- the context, and
- the budget,

the design of the learning events can be optimised for the desired learning outcomes.

5.6.3. Traditional and Flexible Learning.

In the next pair of examples a traditionally taught subject is compared to one that is taught flexibly. A face-to-face language class is compared to a CD-ROM based flexible language-learning package. The traditionally taught language subject was Spanish and offered at first year university level. It was a basic course designed for beginners to achieve a level of spoken and written literacy. The subject was two semesters long and involved six hours of face to face classes each week for 13 weeks. The classes were in three blocks of two hours for day students and two blocks of three hours for part-time students (after hours). Class activities consisted of short lectures, whole class activities such as reading, individual activities, presentations and group work. The facilitator used an overhead projector and handouts as well as the prescribed text and activities books. Each learner was expected to provide their own
Spanish/English, English/Spanish dictionary and to use the resources of the university library. Assessment was by presentation, examination and assignments. An analysis of the traditionally taught Spanish class, using the Learning Activities Model (LAM) yields the following list of activities.

Provision of Material

- Material was provided by the facilitator’s voice, the text and activities books, the overhead projector slides, handouts, dictionaries and reference books.

Interaction with Materials

- Learners interacted with the material in a number of ways. They looked up rules of grammar in the text, they carried out the exercises in the activities book, looked up words in the dictionary and other information in reference books. Interaction with the materials occurred in the classroom but was not limited to it. It could occur in the library, at the learner’s home or wherever learners chose to study.

Interaction with Facilitator (lecturer)

- Learners interacted with the facilitator in several ways. During class the facilitator circulated while learners were working individually or in groups. She answered their questions and checked grammar and pronunciation. Other interaction between the facilitator and learners occurred in consultations and in the comments made by the lecturer on returned assessments.

Interaction between Learners
Learners interacted with each other in the classroom while carrying out group activities. Outside of the classroom they interacted while preparing joint presentations and in other more informal ways.

Intra-action

Intra-action, as discussed earlier, is largely dependent on learner controlled factors. While it can be stimulated or inhibited by learning activities it can also be independent of them.

The flexible learning package consisted of a study guide and a CD-ROM. The commercially produced CD-ROM was purchased by learners and used either at home or in the university computer laboratory. It was in two parts: Beginners Level and Intermediate Level. Each level contained ten chapters or work sessions. Each session required learners to recognise Spanish words in text or sound and learners responded by clicking on the text of a word or a picture. While there appeared to be less grammatical information provided in the package, the advertising material suggested that the philosophy of language learning employed was the same as that of learning a first language, or immersion and hence grammar was not required as a central part of the process. Each work session or chapter had to be completed in one sitting or restarted from its beginning if the student exited the program before finishing and students could ask questions of the teacher by email or during consultation. Using the Learning Activities Model (LAM) to analyse the flexible learning package yields the following list of activities.
Provision of Material

- Material was provided by the CD-ROM in the form of pictures and text on the computer screen, sounds and the text of the study guide. The package was designed to be used in conjunction with other provided materials such as dictionaries and indexes of verbs.

Interaction with the Material

- Interaction with material in the package happened in several ways, all of which required learners to be at a computer. While the predominant interaction was pointing and clicking on a word or picture, learners could also type words and phrases for the CD-ROM to verify or correct.

Interaction with Facilitator

- As the package was flexible in terms of when and where learners learnt, interaction with the facilitator was more limited than for the classroom subject. Learners could email or phone the facilitator or visit them during the designated consultation hours. Some interaction with the facilitator also occurred through the feedback provided in notes on work learners submitted for assessment.

Interaction between Learners

- No interaction between learners was designed into the package. However, if learners were working on campus (for example in computer labs) such interaction could be constructed. Of
course there was no way of defining the exact level and amount of informal (or social) interaction between learners.

Intra-action

- As has been discussed earlier, the final category of activities, Intra-action is dependent on many factors. While most of these are determined by learners others may be dependent on the degree of encouragement or stimulation produced by the activities in the other categories.

<table>
<thead>
<tr>
<th>Category</th>
<th>Traditionally Taught Class</th>
<th>Flexible Learning Package</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Provision of Material</strong></td>
<td>Facilitator’s voice</td>
<td>CD-ROM</td>
</tr>
<tr>
<td></td>
<td>OHTs Text books Handouts</td>
<td>Reference books</td>
</tr>
<tr>
<td></td>
<td>Reference books</td>
<td>Study guide</td>
</tr>
<tr>
<td><strong>Interaction with Material</strong></td>
<td>Taking notes</td>
<td>Computer based</td>
</tr>
<tr>
<td></td>
<td>Looking up rules in reference books</td>
<td>Point and click</td>
</tr>
<tr>
<td></td>
<td>Activities in text</td>
<td></td>
</tr>
<tr>
<td><strong>Interaction with Facilitator</strong></td>
<td>Q+A in classroom</td>
<td>Email, Phone</td>
</tr>
<tr>
<td></td>
<td>Consultation</td>
<td>Consultation</td>
</tr>
<tr>
<td><strong>Interaction between Learners</strong></td>
<td>Group work in classroom</td>
<td>None planned</td>
</tr>
<tr>
<td></td>
<td>Informal</td>
<td></td>
</tr>
<tr>
<td><strong>Intra-action</strong></td>
<td>Possible</td>
<td>Possible</td>
</tr>
</tbody>
</table>

Table 5.3. Learning Activities Model Analysis of a Traditionally Taught Class and a Flexible Learning Package.
Table 5.3 compares the two modes of learning and lists the details of the activities in each category. This representation indicates the differences between the modes for each category of the Learning Activities Model (LAM), as well as the absence of activities in one category for one of the modes. The differences between modes within each category cannot be directly related to the effectiveness of learning without considering factors that are outside of the LAM and beyond the scope of this thesis. For example, it may have been decided that interaction between learners was ‘traded off’ in favour of participation for students who were widely distributed geographically.


Training has been undertaken for as long as it was considered important to pass on skills from one generation to the next and the learning model of master and apprentice is not a new one. Traditionally training in organisations was practiced in several ways. Extraction training, in which learners were “extracted” from the workplace, was traditionally popular for the training of the workforce but has obvious costs. On-the-job training reduces these costs but does so at the expense of the rich learning experience that can be provided by including the presence of a facilitator and other learners.

Four fictitious examples of training are provided and analysed using the Learning Activities Model (LAM). They are:

- An extraction training program,
Chapter 5. A New Learning Activities Model.

- Collaborative Web-Based Training,
- Print-Based Independent Learning, and
- Independent Web-Based Training.

The examples are intended to illustrate the use of the Learning Activities Model in the analysis of various modes of training.

5.7.1. Extraction Training and Web-Based Training.

Many organisations have successfully used training programs for many years in which participants are extracted from their workplace and gathered together, often in a designated training environment. The training may be for one of a multitude of purposes and training sessions can vary in length from minutes to days or be scheduled periodically over a number of weeks or years. While presentations are viewed by many as the basis for this type of training program, there is agreement that presentations are not considered appropriate in many cases (Moss 1993, Nadler and Nadler 1994) and that a more participatory approach is generally preferable. Participatory learning activities can involve things like, brainstorming, case studies, debates, demonstrations, forums, games, peer teaching, simulations, workshops and many more. Of course presentations are not ruled out completely as they can be efficient ways to transmit information or provide material.

Analysis of extraction training programs, using the Learning Activities Model (LAM) indicates that material can be provided through the voice, handouts and audio visual aids the presenter uses or through materials
distributed or encountered in the program and learners can interact with
the materials in a number of ways. Opportunities for interaction with the
facilitator can be provided in extraction training and can be in the form of
questions and answers or comments. Opportunities for interaction
between learners can be structured, as in group work, or can be informal
such as a lunchtime discussion. As was the case in the Higher Education
examples, the final category of activities, Intra-action is dependent on
many factors. While learners determine most of these, others may be
dependent on the degree of encouragement or stimulation produced by
the activities in the other categories or by other factors.

The development and proliferation of the Internet and the World Wide Web
in years since the mid1990s, has made Web-Based Training possible.
Many organisations use the web for training with examples ranging from
the simple, such as information retrieval, to the complex in which learners
may engage in Online Discussions and work in virtual groups. The
earliest use of the web was for the provision of material which was in the
form of text, pictures diagrams and charts, audio and video. More recently
the web has also been used to host collaboration through tools such as
text-based Online Discussions. These have been included in Web-Based
Training to allow for interaction with the facilitator and interaction between
learners. The presence of a cohort of learners can be the factor that
determines which of these approaches to Web-Based Training is used.
Where a cohort is absent learning is primarily an individual process and is
independent of other learners and the facilitator and the learning activities
are carried out independently. Devices such as lists of Frequently Asked Questions (FAQs) can provide an emulation of interaction with learners and interaction with the facilitator. To clearly differentiate between these two approaches they are referred to here as Collaborative Web-Based Training and Independent Web-Based Training.

One of the benefits of Web-Based Training over face-to-face extraction training is the flexibility of time and place of training. Learners can undertake training during downtime or when it suits the task as collaboration in Web-Based Training can be asynchronous. As well they can undertake training without having to travel to a training venue.

Table 5.4 compares the analysis of extraction training and Collaborative Web-Based Training. It lists the details of the activities in each category and indicates the differences between the modes for each category of the Learning Activities Model (LAM). The differences between modes within each category cannot be directly related to the effectiveness of learning without considering factors that are outside of the LAM and beyond the scope of this thesis. For example a cost-benefit analysis in which costs include transporting learners to the learning venue and time off the job could be a deciding factor.
Table 5.4. Learning Activities Model Analysis of Extraction Training and Collaborative Web-Based Training.

5.7.2. Independent Learning.

Independent learning is common in many organisations. In contrast to extraction training, Independent learning is often on-the-job and is, by definition, undertaken by individuals in the absence of other learners or a facilitator. Independent learning can be used for a range of purposes including the acquisition of skills, know-how or procedures. It follows that, in a broader context, independent learning happens whenever a learner consults a manual or set of instructions and successfully completes a new or difficult task. Material for independent learning can be provided by a
technology such as the web or print. For example a software designer might learn a new programming sequence from a book or an accounts clerk may consult online help to undertake a new accounting procedure. When the learning is on-the-job, interaction with material is often through reading, viewing or pointing and clicking (in the case of computer-based training) and the learner usually applies what they have learnt to the job immediately. One of the benefits of independent learning is that it can be undertaken at a time that suits the learner, the organisation and the task. Learners may interact with the materials through direct application or by following instructions. As the training is carried out independently there is usually no interaction with the facilitator or between learners. Of course there are exceptions, such as cases where the learner does not achieve the learning outcome and may consult with a peer or ask a supervisor. As in other modes of training Intra-action is possible, but determined by the learner and hence difficult to prescribe.

Table 5.5 compares the analyses of print-based independent learning and independent Web-Based Training. It lists the details of the activities in each category and indicates the differences between the modes for each category of the Learning Activities Model (LAM). The differences between modes within each category cannot be directly related to the effectiveness of learning without considering factors that are outside of the LAM and beyond the scope of this thesis. For example while Web-Based Training can easily deliver recently updated information to many locations, it is necessary to have access to a networked computer to access it, which
could be problematic in remote or difficult locations. This contrasts to the use of print-based field manuals which may used some distance from a computer or power source.

<table>
<thead>
<tr>
<th>Category</th>
<th>Independent Web-Based Training</th>
<th>Print-Based Independent Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of Material</td>
<td>Web material – text and graphics</td>
<td>Manual/instructions in print Reference books</td>
</tr>
<tr>
<td>Interaction with Material</td>
<td>Reading</td>
<td>Reading</td>
</tr>
<tr>
<td></td>
<td>Viewing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Point and click</td>
<td></td>
</tr>
<tr>
<td>Interaction with Facilitator</td>
<td>Not planned</td>
<td>Not planned</td>
</tr>
<tr>
<td>Interaction between Learners</td>
<td>Not planned</td>
<td>Not planned</td>
</tr>
<tr>
<td>Intra-action</td>
<td>Possible</td>
<td>Possible</td>
</tr>
</tbody>
</table>

Table 5.5. Learning Activities Model Analysis of Print-Based and Web-Based Independent Learning.

Further examples of the application Learning Activities Model (LAM), including its use in the design of subjects, are provided in Appendix 1.

5.8. Conclusion.

The Learning Activities Model (LAM) has been developed for two types of purpose. Firstly it provides a theoretical framework for analysis of learning activities and secondly to assist facilitators and designers of learning
events in the design process by subdividing learning events or programs into categories of activities. It can be used in a formative way to analyse a proposed learning event or program or in a summative way to assist in the revision of an existing learning event or program. The Learning Activities Model (LAM) can also be used to compare different methods and modes of achieving learning goals.

There are some things that the Learning Activities Model (LAM) cannot, and is not intended to do. It will not prescribe the best mixture of activities to use for a particular learning event or content area. It is not sensitive to the cultural and demographic make-up of learners. The facilitator is usually the expert on the content and the facilitator or designer should have created a profile of the learners and hence they are best placed to match the activities of the model with the content and the learners.

The Learning Activities Model (LAM) is the first of two theoretical frameworks that have been developed and can be combined to form a Technology Selection Method for the design of learning events. In the next chapter learning technologies and techniques are analysed, and a Learning Technologies Model (LTM) is presented. In Chapter Seven the two models (LAM and LTM) are brought together to form the Technology Selection Method (TSM) in which technologies, analysed by the Learning Technologies Model (LTM), are matched categories of activities in the Learning Activities Model (LAM).
Chapter 6

A New Learning Technologies Model.

6.1. Introduction.

The Learning Activities Model (LAM) developed in the previous chapter provides a theoretical framework for the analysis of the process of learning through the categorisation of activities. During the design of learning events, different techniques, methods and technologies can be applied to activities within each category or to complete categories. This matching process is, in essence, the basis of the Technology Selection Method (TSM), presented in Chapter Seven. However, before technologies that are appropriate to learners and learning events can be selected it is essential to have a clear understanding of the nature and capabilities of the technologies. To assist in the understanding and analysis of learning technologies, a theoretical framework of them is presented.

The theoretical basis for the Learning Technologies Model is provided, in part, by researchers in the field of Distance Education through their
description of learning technologies as one-way or two-way (Bates 1995, Rowntree 1992, Taylor 2001). Writing in the area of Open and Distance Learning, Bates distinguishes between one-way and two-way technologies by stating that two-way technologies are those that support communications between humans.

“The significance of two-way technologies is that they allow for interaction between learners and instructors or tutors, and perhaps, even more significantly, for interaction between distance learners themselves.” (Bates 1995, p 32)

The research reported on here takes this rather basic conceptual approach, redefines it and juxtaposes it with theories developed for technology selection in the field of Organisational Communications to produce a new theoretical framework for the analysis and categorisation of learning technologies. This forms the basis of the Learning Technologies Model (LTM). The Learning Technologies Model (LTM) is the second original theoretical framework developed in this thesis and can be used to assist learning designers in the analysis of learning technologies as well as in their selection. When the selection of learning technologies is addressed in Chapter Seven, learning technologies, as analysed by the Learning Technologies Model (LTM), will be matched to categories of the Learning Activities Model (LAM).
The LTM has been developed in two stages. Firstly the two theoretical dimensions are juxtaposed to form a matrix. Secondly the matrix is extended to include two further criteria by which characteristics of learning technologies can be classified. These are: the categories of the Learning Activities Model to which the technology is inherently suited, and the degree to which the technology supports synchronous or asynchronous interactions. Examples of the analysis of several technologies by the LTM are provided later in this chapter to illustrate the model.

As with different methods of communication, different teaching techniques, methods and technologies support or require different attributes or communication cues. For example, a discussion where learners are gathered at the same time and in the same place can consist of a dialogue in which several levels of attributes can be present. Learners hear the text of the speech. They also hear the emphasis, pace, volume, pitch, and inflection and other vocal attributes of the speech. Also, they see the body language and other non-verbal communications of the speakers. As well learners may have the opportunity to question the speaker and hopefully achieve the desired goals of the learning event. In a second example where material is provided by a textbook, learners read the text and view the diagrams in it. While, the vocal and non-verbal attributes of the first example are not available, the learner has the option to find their own way through the book. They can elect to read from beginning to end or to repeat or dwell on salient sections and skim through others. They can refer to the index and other devices in the book.
In Chapter Three, theories for the selection of technologies for Organisational Communications were discussed. Two early trait theories developed scales of richness or ability to facilitate social presence. The Media Richness Theory (Daft and Lengel 1984) and The Social Presence Theory (Carlson and Davis 1998) both describe technologies as having degrees of richness based on:

- The number of communication cues available,
- The ability to provide feedback,
- Personalisation, and other factors.

For example both theories determine that face-to-face communication is richer than telephone, which in turn is richer than a written letter or memo. Later research (Carlson and Davis 1998, Guthrie 2000) has indicated that the choice of technology is more complex, and has been made so by other factors such as the introduction of Information and Communication Technologies late last century as these technologies often have other attributes that impact on their choice. For example, while email messages equate with written letters and memos in terms of communications cues (both are usually text only) other features of email can affect its choice in Organisational Communications. The ease with which email messages can be stored and retrieved, sent to multiple recipients, access controlled, and priority assigned are features that can play a role in the process of deciding on choice of technology.

While it is recognised that the trait theories fall short of providing an inclusive description of the factors that impact on the selection of
technologies, they do provide a convenient hierarchy within which an analysis of technologies can be undertaken. The hierarchy is adopted as one dimension of the matrix which forms the basis of the theoretical framework as it allows the differentiation of technologies based on communicative cues, or attributes. When technologies are then matched to categories of the Learning Activities Model (LAM) it can be ensured that each technology is suited to the corresponding category and that it can support the communication attributes necessary or desired for learning.


Compared to face-to-face learning, when learning technologies are used to provide, facilitate or mediate learning activities, they can impose restrictions on the communication cues available. For example, if a discussion is mediated by an audio-conference, participants at one site cannot see those at other sites and hence the non-verbal attributes of the dialogue of speakers at the other sites are not available. Further, if the discussion was mediated by email or Internet Chat, the only available attribute of the dialogue would be text.

There are too many variables for it to be argued that that fewer available communication cues or attributes in a learning technology will always equate to a reduction in the quality of learning experience. In some cases a reduction in the set of attributes or communication cues can enhance the learning experience through the provision of a narrower focus. In other cases there may be “trade-offs” that are worthwhile. For example if
learners elect to study at times and places that suit themselves they may be limited to interacting with other learners and the facilitator by asynchronous and communicatively limited means such as email. For them the “trade-off” is a reduction in the attributes or communication cues in favour of a flexible learning program.

Based on research in the area of open and Distance Learning (Bates 1995, Rowntree 1992, Taylor 2001), in the proposed Learning Technologies Model (LTM), learning technologies are first categorised as those that support:

- the one-way representation of material, or
- two-way interactions between humans or dialogues.

The one-way learning technologies are labelled as "Representational" and the two-way as "Dialogic". There are examples of learning technologies that perform in both categories, although usually their performance in one category is more effective and/or more efficient than in the other. This division is helpful in the selection of technologies that provide appropriate communication for the achievement of the planned learning objectives. In Representational technologies the flow of information is generally one-way from the technology to the learner. In Dialogic technologies the flow of information is two-way between users of the technology.

For example the information in printed materials (a Representational technology) clearly flows from the text to the reader. However by interacting with the text the reader makes sense or meaning of the text. Dialogic technologies facilitate a dialogue or two-way flow of information.
between humans. When a telephone call is made between two parties the information is usually two-way and flows between them.

The term "Representational" is used here to describe the nature of the communication in the one-way representation or provision of material. Different technologies used for the provision of material have different capabilities or attributes of representation. For example, while printed materials can only represent material as text and still images (and in many cases as text alone), video can represent material with full motion pictures and audio. The available attributes of Representational learning technologies can be broadly categorised as:

- Text only,
- Audio only,
- Text and still images,
- Audio and still images, and
- Audio and moving images.

Within the Representational category of learning technologies the level of the available attributes of representation is presented as a means of analysis and as a way to further understand the technologies and to assist in the selection of them for use in learning events.

For the second category of learning technologies, the term “Dialogic” is used to describe the nature of the two-way communication. Similarly to
the first category, different technologies within this category support
different dialogic attributes. For example, while telephones support
dialogue in which the words, or text, of each speaker contributes to the
interaction they also support vocal characteristics such as timbre,
inflection, emphasis, pitch, pace, tone and volume. Within the Dialogic
category of learning technologies the level of the available attributes of
dialogue is presented as a tool to further understand the technologies and
to assist in the selection of them for learning. The attributes can be
broadly grouped as:

- Text only
- Voice only, and
- Voice and non-verbal attributes

In the above list, voice could be thought of as consisting of text plus the
vocal attributes mentioned earlier. The non-verbal attributes refer to eye
contact, body language, etc. Hence voice plus non-verbal attributes can
be thought of as text plus vocal attributes plus non-verbal attributes. Table
6.1 shows the cumulative or developmental nature of the attributes of
dialogic technologies.

<table>
<thead>
<tr>
<th>Channel</th>
<th>Communication cues</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Print</td>
<td>Text</td>
</tr>
<tr>
<td>2. Voice</td>
<td>Text plus vocal attributes</td>
</tr>
<tr>
<td>3. Face-to-face</td>
<td>Text plus vocal attributes plus body language</td>
</tr>
</tbody>
</table>

*Table 6.1. Attributes of Dialogic Technologies.*

The attributes of learning technologies can be grouped into three levels of communications cues (as indicated in Table 6.1) and used as one axis or dimension of the matrix that forms the basis of the Learning Technologies Model (LTM). The second axis of the matrix is based on the work discussed earlier that describes learning technologies as one-way or two-way, referred to in this thesis as Representational or Dialogic. When the categories of attributes are generalised for both Dialogic and Representational technologies the resulting matrix forms the basis of the Learning Technologies Model (LTM) as shown in Table 6.2.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Representational</th>
<th>Dialogic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 1</strong></td>
<td>- Text only</td>
<td>- Text only</td>
</tr>
<tr>
<td></td>
<td>- Text and still images</td>
<td>- eg: email or CMCs</td>
</tr>
<tr>
<td></td>
<td>- eg: printed material</td>
<td></td>
</tr>
<tr>
<td><strong>Level 2</strong></td>
<td>- Voice and other audio</td>
<td>- Voice only</td>
</tr>
<tr>
<td></td>
<td>- sound effects</td>
<td>- eg: telephone - compressed hence vocal attributes may be less apparent.</td>
</tr>
<tr>
<td></td>
<td>- found sound</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- music and other sounds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- eg: radio broadcast, audio tape</td>
<td></td>
</tr>
<tr>
<td><strong>Level 3</strong></td>
<td>- Voice and moving pictures</td>
<td>- Voice and image (face to face)</td>
</tr>
<tr>
<td></td>
<td>- Plus other audio</td>
<td>- Plus non-verbals (if resolution is sufficient)</td>
</tr>
<tr>
<td></td>
<td>- Plus non-verbal when presenter on screen and close.</td>
<td>- Plus other audio</td>
</tr>
<tr>
<td></td>
<td>- eg movie or video tape</td>
<td>- Plus other images still or moving</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- eg video-conference</td>
</tr>
</tbody>
</table>

Table 6.2. The Basis of the Learning Technologies Model (LTM).

While the two dimensions: level of attributes supported and Representational or Dialogic nature, present a valuable start to a framework for the analysis of learning technologies, there are other
characteristics that impact on the activities of learning and hence need to be considered in the framework in order to increase the applicability and general usefulness of it. These characteristics are whether the technology supports synchronous or asynchronous interactions and the learning activities to which the technology is inherently suited.

### 6.6. Other Characteristics of Learning Technologies.

Learning technologies can be described as either synchronous or asynchronous. This refers to the interactions between learners, between facilitators and learners, and between learners and materials. Synchronous interactions are those that happen more or less at the same time. Asynchronous ones do not. For example, videoconferences are described as synchronous, meaning that learners, or learners and the facilitator participate in the conference at the same time. Email and Internet Chat (both are described later in this chapter) provide a good example of the difference between synchronous and asynchronous technologies. Email is usually responded to at the discretion of the user and hence is described as asynchronous. However, when in a Chat session each participant knows that the others are waiting for their responses. The resulting “conversations” are synchronous, develop at their own pace, are quite different from email interactions and hence serve different learning purposes.

In the early days of the Internet, and as its use for learning increased, the debate over the benefits of asynchronous versus synchronous
communication gained momentum as the Internet provided efficient and available applications for both synchronous and asynchronous communications. Some proponents suggested that asynchronous communication was, by its very nature, of a higher quality (in both learning and communications senses) as learners had time to consider their responses. Others maintained that the spontaneity learners were used to with face-to-face communication was all-important. It is argued that both types of communication have roles to play in learning. Asynchronous communications certainly provide opportunities for learners to meet learning objectives that require them to consider their responses, while synchronous communications can help learners develop skills such as "thinking on their feet". Both forms of communication have valid and different uses in learning and surely the best use of a learning technology occurs when it is selected to meet a synchronous or asynchronous learning need.

Synchronous communication on the Internet can be as fast as face-to-face but this is rarely the case. For example, to "chat" on the Internet the “speaker” types their message which is then loaded to the Chat Room or host. All of this takes time and reduces the speed of the interaction. Experienced “chatters” obviously dislike this delay and have developed a shorthand and system of language shortcuts and icons (often called “smilies” or emoticons) to speed up the typing of the conversation.
Another characteristic of learning technologies incorporated into the Learning Technologies Model is the technology’s inherent suitability to particular learning activities. As mentioned earlier, some technologies are one-way or Representational and suited predominantly to the categories of the Learning Activities Model (LAM) of Provision of Materials and Interaction with Materials. Other technologies are Dialogic and more suited to the interaction categories of the LAM and the matching of technologies to categories of the LAM, forms the basis of the Technology Selection Method, discussed in Chapter Seven.


The Learning Technology Model brings together the nature and attributes of learning technologies, as illustrated in Table 6.2 with the criteria mentioned above, of synchronous/asynchronous nature and suitable categories of the Learning Activities Model.

Figure 6.1 is an example of the graphical representation of the Learning Activities Model (LTM). When technologies are analysed by these criteria, and the results represented in tabular form, the resulting robust tool provides a theoretical framework of learning technologies that has theoretical and practical applications.

Many other conceptualisations of learning technologies are less robust than the Learning Technologies Model (LTM) as they are either simple and only classify technologies by their characteristics or relate only to a
finite group of technologies available and in favour at the time of publication.

Figure 6.1. An Example of the Learning Technologies Model (LTM).

The LTM links learning technologies to applications and provides an insight into the nature and characteristics of the technology, which makes possible extension of the use of the technology. As well the framework can be used to analyse future technologies.

As it is beyond the scope of this thesis to analyse all Information and Communication Technologies, a number of learning technologies that can reasonably be expected to be available to designers for use in learning events is analysed using the Learning Technologies Model. The technologies are:

- Print,
- Radio and Recorded Audio,

- Television and Video,
- Videoconference,
- Multimedia,
- Internet, consisting of:
  - World Wide Web,
  - Internet Chat,
  - Online Discussion,
  - Email and Listservers, and

An analysis of each of the above technologies is provided to illustrate the Learning Technologies Model.

6.7.1. Print.

For the purpose of this thesis, print is defined as printed symbols (letters, numbers, diagram, pictures, etc.) on paper. Typically in learning events print appears as manuals, textbooks, study guides, course notes, etc. Print is probably one of the oldest learning technologies and generally considered central to learning.

“Ever since the invention of the Gutenberg press, print has been the dominant teaching technology, arguably at least as influential as the spoken word of the teacher. Even today, print dominates as the main technology of teaching in formal education, training and distance education.” (Bates 1995, p 116)
Bates, and Kemp and Smellie also describe the use of print in education as primarily being one of presenting information or the representation of things.

“Through text, print can precisely represent facts, abstract ideas, rules and principles, and detailed, lengthy or complex arguments ... Print then has traditionally been the main means of presenting information in education.” (Bates 1995, p 119)

“A number of materials, prepared on paper, may serve instructional or informational purposes. They are classified as printed media and consist of three groupings: (1) learning aids, (2) training materials, and (3) informational materials.” (Kemp and Smellie 1989, p 45)

As well as the presentation, or provision of material, Bates (1995) argues that students need to interact with print if they are to derive meaning from it.

“Thus a text is not a neutral object; its meaning depends on the interpretation of the reader, whether it is a work of great literature or a car repair mechanic’s manual. Therefore if the reader is to obtain meaning from a text, there has to be an interaction.” (Bates 1995, p 120)
It is generally known that the predominant use of print in learning is for the presentation of material in a form that can be conveniently accessed by learners. To learn from it, learners need to interact with the text on a cognitive level mentioned by Bates above as well as on a physical level through access devices such as indexes, headings and sub-headings, summaries, self assessment questions, glossaries, etc. By contrast and implicitly, print as described here does not play a great role (if any) in the categories of: Interactions between Learners and Interaction with the Facilitator in the Learning Activities Model (LAM). Print is obviously suited to the categories: Provision of Materials and Interaction with Materials. While print can be used to host a dialogue through letters, this is rarely the case in a learning context outside of correspondence courses.

<table>
<thead>
<tr>
<th>Print</th>
</tr>
</thead>
<tbody>
<tr>
<td>Representational, Level 1</td>
</tr>
<tr>
<td>Asynchronous</td>
</tr>
</tbody>
</table>

**Learning Activities Model (LAM)**  
Suitable categories are:  
Provision of Materials (PM)  
Interaction with Materials (IM)

Table 6.3. Learning Technologies Model: Print.
The literature concurs that print is generally used for the presentation of material and it follows that print is a Representational technology in the Learning Technologies Model (LTM). As print consists of text and still images, it is of level one attributes. Print is generally considered to be an asynchronous technology as the preparation of it is generally performed prior to its use. The analysis of the learning technology, Print using the Learning Technologies Model (LTM) is shown in Table 6.3.

6.7.2. Radio and Recorded Audio.

Radio and recorded audio have been used in learning for some time. Bates describes radio as having a number of uses in learning contexts.

“The uses include school broadcasting, informal general education, social action programming and adult basic education and literacy.”

(Bates 1995, p 139)

Writing in 1995, Bates also describes audio-cassettes as the most cost-effective learning technology. In some cases audio-cassettes have been used as a vehicle for learners’ feedback to facilitators. For example in some language learning where learners record oral exercises on tape and deliver them to the facilitator for evaluation and/or examination. However, in the main, audio programs in education are of the pre-recorded type. Today audio-cassettes have all but been replaced by audio CDs as a recorded audio technology. Once popular, today radio broadcasts have
limited use in Flexible Learning and in many cases the broadcast is recorded and provided to students as audio CDs or audio-cassettes.

Moore and Kearsley suggest that recorded audio can be used for a number of learning purposes that include:

- talking learners through printed resources, real objects and/or practical procedures
- Analysing human interactions, and
- Providing aural experiences.” (Moore and Kearsley 1996, p 84)

Recorded audio is generally used to present material and as such audio recordings are asynchronous, one-way technologies and are described as Representational in the Learning Technologies Model (LTM). As well they have level two attributes as they can contain text (spoken) and vocal attributes (see Table 6.2). Interaction with audio is usually limited to replaying sections of the program and the categories of the Learning Activities Model (LAM) this technology is suited to are Provision of Material and Interaction with Material. The analysis of the leaning technology, radio and recorded audio by the Learning Technologies Model (LTM) is shown in Table 6.4.
6.7.3. Television and Video.

The reporting of the use of television in the literature concerned with learning technologies is confused by the problems of definition. In North America many reports on educational television refer to the technology as interactive videoconferences. These use broadcast television and students communicate with the “on-air” teacher via a telephone. For the sake of clarity, for this thesis television is restricted to prepared programs broadcast with no intention of interaction with the on-screen identities. That is, programs that are generally encapsulated in a medium such as videotape, videodisc or DVD and the material has been prepared before its broadcast or viewing.

The newer technology for video replay, DVD, has the potential to provide rich learning materials as it can combine a menu structure with full screen,
high quality video and has capabilities, unique to DVD, to replay different pieces of video in a seamless manner.

“Writing for DVD is somewhat similar to writing branched scripts for multimedia that traditionally would have been distributed on CDROM. However the unique abilities of DVD such as selectable angles and the ability to seamlessly concatenate scenes from different parts of the disc add a third dimension to the script. These attributes of the script structure will allow users to customise their own learning experience to their needs.” (Caladine 2001, p 120)

Television and video have been used in learning contexts for many years as useful adjuncts to learning and have been used to provide educational course material, especially in Distance, Open and Flexible Learning programs. It is generally known that television and video are suited to the display of action, objects, colour and motion. If action or movement is not required then a still photograph may be cheaper and probably have more clarity or resolution. Television is suited to the display of moving things and three-dimensional objects, for example: the training of sales staff in new product knowledge.

New product or process training required large audience coverage in a short time. Business Television was the solution for that need … this high-production value allowed learning to reach wide
audiences with limited feedback requirements. Knowledge transfer worked well.” (Berge 2001, p 275)

Clearly when television or video is used in this way, it is an asynchronous, one-way technology and can be described by the Learning Technologies Model (LTM) as a Representational technology of level three attributes. As interaction with television is rather limited and interaction with video is limited to pause and replay, it is suited to the category of Learning Activities Model (LAM) of Provision of Materials. Learners can interact with the material on videotape, disc or DVD through stopping and reviewing sections of the material.

<table>
<thead>
<tr>
<th>Television and Video</th>
</tr>
</thead>
<tbody>
<tr>
<td>Representational, Level 3</td>
</tr>
<tr>
<td>Asynchronous</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Activities Model (LAM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suitable categories:</td>
</tr>
<tr>
<td>Provision of Materials (PM)</td>
</tr>
<tr>
<td>Interaction with Materials (IM)</td>
</tr>
</tbody>
</table>

Table 6.5. Learning Technologies Model: Television and Video.

This mechanical type of interaction can lead to clarification and the desired learning outcomes and hence video is suited to the Interaction with
Materials category at this level. The analysis of the learning technology, television and video by the Learning Technologies Model (LTM) is shown in Table 6.5.

6.7.4. Videoconference.

In the literature, and as mentioned in the previous section, the term “videoconference” is used to describe two different technologies. For some it refers to a one-way broadcast television program with participation from students through telephone calls to the presenter while he or she is on air. In the Australian context the term “videoconference” is used to describe a technology which usually uses publicly or privately owned telecommunications lines to transmit and receive two-way audio and two-way video. In these two-way videoconferences, participants gather at videoconference equipped rooms or studios and connect to parties at other such rooms or studios. The technology involved typically consists of:

- Video cameras to capture the images of participants and documents etc,
- Microphones to capture the audio,
- Television style monitors to view and hear the other parties, and
- CODECS (compressor/decompressor or coder/decoder) to reduce the size of the signal (video and audio) to a level suitable for transmission.
While much has been written on the technical details of videoconferences, only a limited amount has been written on the use of this technology for learning and even less about such in the Australian context. However, the literature concurs on the issue of the importance of interaction to the process of learning using videoconference.

“This is an interactive medium and a visual medium. I believe it works particularly well with relatively small groups of say, twenty or thirty. and[sic] in situations where students at both sites can interact with their peers as well as with their teacher, tutor or trainer. It is an excellent [sic] for cognition building for tutorials, roles, plays [sic], simulations, brainstorming, problem solving, case study work and so on.” (Latchem in Mitchell 1993, p 76)

Daunt reinforces the importance of interaction in videoconferences and describes facilitators of videoconferences in learning as “teleteachers”.

“Most teleteachers agree that interaction is an important element in their teaching - after all it is the only thing that distinguishes teleteaching from a video tape! Interactivity takes many forms; it is not just limited to audio and video, or just teacher-student interactions. It represents the connectivity students feel with the teacher, the local tutors and their peers.” (Daunt 1997, p 109)
Laurillard describes videoconferences as a discursive media and suggests that “as a way of transmitting a didactic lecture, a video would be cheaper and easier” (Laurillard 1993, p 167). Kobayashi, Tanaka, Yamaji and Otsuka reflect on their experience with video-conferences in higher education that:

“the least effective forms of discourse were those which were monologues/explanations/lectures, where the sole purpose of communication was the transmission of information.” (Kobayashi et al, p 247)

The author’s experience with videoconference in learning is congruent with the view that they are suited to interaction rather than presentation.

“One-way presentations (such as lectures) are not appropriate for videoconferences and it is probably cheaper, as well as more educationally effective to send the one-way information in text or on an audio- or videotape” (Caladine 1999, p 138)

The literature concurs that videoconference is best used as an interactive technology in learning. Hence in the Learning Technologies Model (LTM), it is a Dialogic technology and as it supports voice and image, has level three attributes. As such it is clear that videoconference is suitable for the categories of the Learning Activities Model (LAM) that concern interactions between humans: Interaction between Learners and Interaction with
Facilitator. As all parties need to be connected to the videoconference at the same time it is a synchronous technology. The description of the learning technology, videoconference by the Learning Technologies Model (LTM) is shown in Table 6.6.

<table>
<thead>
<tr>
<th>Videoconference</th>
<th>Dialogic, Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronous</td>
<td></td>
</tr>
</tbody>
</table>

**Learning Activities Model (LAM)**
- Suitable categories:
  - Interaction Between Learners (IL)
  - Interaction with Facilitator (IF)

![Diagram of Learning Activities Model (LAM)]


### 6.7.5. Multimedia.

The term Multimedia is often used to describe a style of computer-mediated presentation or program which incorporates two or more specific elements. Often the elements number more than two and can include: audio, still pictures, moving pictures, and text. One of the many definitions contained in the literature, states that multimedia is defined by the elements it contains.
“Multimedia is defined as an interactive, computer mediated presentation that includes at least two of the following elements: text, sound, still graphic images, motion graphics and animation,”
(Tannenbaum 1998, p 4)

Tannenbaum’s definition is rather broad and can describe electronic books, streamed video and World Wide Web pages. For this thesis, multimedia is defined as a computer program that, contains at least three of the elements mentioned above and is usually distributed on a web page, CD-ROM or is used from a computer hard drive. Multimedia as defined here cannot host interaction with the facilitator, designer or interaction between learners. While the interactions learners have with multimedia can emulate interactions with other humans, they are limited by two factors. Firstly, interaction is not with a live facilitator or designer, rather it is with the essence of them. Questions and answers contained in a multimedia program are usually assumed by the designer or are those frequently asked when the material is presented in a different format. In this way the emulation of interaction with the facilitator is limited. Secondly, the material and essence of the facilitator or designer is encapsulated within the technology and hence the material is fixed in time thus imposing a potential limit to the new knowledge that can be constructed in this way. Unfortunately the nature of multimedia does not lend itself to easy or inexpensive updating hence shelf-life has to be a major consideration in the planning of multimedia. However, within the limitations mentioned Multimedia has many uses in learning that range in complexity from skills
acquisition, for example in language learning, through to complex simulations. Kruse and Kiel describe Multimedia as CD-ROM and suggest that if offers advantages over traditional modes of training.

“CD-ROMs provide a more engaging learning experience, with text, audio, video and animations all used to convey information… the use of multiple media means that learning is optimised…” (Kruse and Keil 2000, p 45)

Clearly, while Multimedia can be apparently synchronous as learners interact with the material in real time, it is argued that it should be considered an asynchronous technology as the material is gathered, authored and encapsulated prior to its use. In the Learning Technologies Model (LTM) Multimedia is a Representational technology but as well can be considered a Dialogic one if a dialogue can be had with a computer. Some Multimedia programs are highly Representational and others can be highly interactive. In Chapter Five the dual definition of interactivity was discussed and the use of the term “interaction” was adopted in this thesis to mean interactions that are reciprocal and to include the “interactivity” of a computer responding to a user’s input. However, as the interaction is limited to a computer program, for this thesis Multimedia is described as a Representational learning technology. As Multimedia can contain audio, video as well as text and animations it has level 3 attributes. As Multimedia does not provide interaction between learners or interaction with the facilitator the categories of the Learning Activities Model it is
suited to are Provision of Materials and Interaction with Materials. The analysis of the learning technology, Multimedia by the Learning Technologies Model (LTM) is shown in Table 6.7.

<table>
<thead>
<tr>
<th>Multimedia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Representational, Level 3</td>
</tr>
<tr>
<td>Asynchronous</td>
</tr>
<tr>
<td>Learning Activities Model (LAM)</td>
</tr>
<tr>
<td>Suitable categories:</td>
</tr>
<tr>
<td>Provision of Materials (PM)</td>
</tr>
<tr>
<td>Interaction with Materials (IM)</td>
</tr>
</tbody>
</table>

Table 6.7. Learning Technologies Model: Multimedia.

6.7.6. Internet.

The use of the Internet for learning in the Higher Education and Human Resource Development contexts has grown with remarkable speed. Most universities have some degree of Online Learning and many organisations use, or plan to use, the Internet for training. The rapid uptake of the use of the Internet for learning is probably due to its almost ubiquitous, and pervasive nature and the concomitant efficiencies of communication it offers. The use of the Internet can clearly be divided into two distinct categories of functions that reflect the primary differentiation of
technologies in the Learning Technologies Model (LTM): Representational and Dialogic.

Initially, Representational uses of the Internet were limited to the retrieval of files from servers. More recently, with the advent of the World Wide Web, Representational uses have been dominated by the viewing and reading of web pages as well as the retrieval of files linked to them. The files may be of any format such as Portable Document Format (.pdf) or files created with word processing applications, graphics files, streamed audio or video.

One of the first Dialogic uses of the Internet was electronic mail or email. Email is still one of the most used applications of the Internet. As well as email two other Dialogic applications of the Internet can be used in learning events. They are Internet Chat and Online Discussions. Email, Internet Chat and Online Discussions can be situated within a web page or can be stand-alone applications and detailed descriptions and analyses of these Dialogic Internet technologies are given later in this chapter. Perhaps the most significant development in Internet applications is the World Wide Web.

6.7.6 (a). World Wide Web Pages for Information Retrieval.

The World Wide Web (www) came into being in 1993 and within a few years became the way most people use the Internet. This revolution in Internet use was primarily due to the user-friendly nature of the web
afforded by its Graphic User Interface (GUI). The following definition of
the World Wide Web is taken from a web-based encyclopaedia of
computer terms.

“A system of Internet servers that support specially formatted
documents. The documents are formatted in a language called
HTML (HyperText Markup Language) that supports links to other
documents, as well as graphics, audio, and video files. This means
you can jump from one document to another simply by clicking on
hot spots. Not all Internet servers are part of the World Wide Web.
There are several applications called Web browsers that make it
easy to access the World Wide Web; Two of the most popular
being Netscape Navigator and Microsoft's Internet Explorer.”

There are tens of millions of web pages on servers (or host computers) in
many countries in the world and they are used for many purposes
including, business, eCommerce, learning, social interaction, etc.

In a learning context, using the web for information retrieval clearly fits
within the Provision of Material and Interaction with Materials categories of
the Learning Activities Model (LAM). Learners interact with material on the
web by searching, navigating, selecting, assessing, evaluating and
managing information. However, evaluating information takes on a
greater significance for information that is on the web. For a small price
almost anyone can put anything on the web and so learners need to develop keen evaluation skills and hence use the material they have retrieved appropriately. Designers or facilitators of learning events need to ensure that learners develop a set of skills that includes these evaluation skills as well as search and retrieval skills.

The majority of the information on the web is in text and still images. Hence, when the web is used as a resource for the retrieval of this type of information, it is being used as a Representational technology with level one attributes. Through the use of streaming or progressive download technologies, video and audio files can be placed on web servers and retrieved by users. However, such files are usually large in size and take time to download. While, in the past download time has probably been the main reason against the widespread use of video and audio on the web, the growth of broadband connections to the Internet and recent advances in compression technology are reducing the download time with tolerable losses in quality of image and sound. When video and audio are included in web pages the capability of the technology rises to level three. As web pages are generally constructed prior to their hosting and use they are considered an asynchronous technology. The description of the learning technology, the World Wide Web, for information retrieval, by the Learning Technologies Model (LTM) is shown in Table 6.8.

6.7.6 (b). Internet Chat.

Internet Chat is a synchronous, text-based emulation of a conversation that uses the Internet to connect participants. It can be point to point where the communication is simply between two parties who have the same Chat software package and have logged onto it at the same time or it can be multipoint where more that two “chatters” log onto a server, or “chat room” and “talk” to whoever else is logged on. The Internet Chat program shown in Figure 6.2 is one of several that are shareware and hence is inexpensive. Chat programs can be stand-alone or located within a web page, for example a web-based learning environment. To use a Chat program, comments are typed into the input box and then sent to the
server by pressing the enter key or clicking on a button. The comment
then appears in the Chat window.

![Internet Chat: an example.](image)

As Chat is synchronous the text-based conversation style tends short, to
the point and highly interactive and chatters have developed a shorthand
and use emoticons (smilies) to assist the conversation. It follows then that
the use of Internet Chat in education is best where this type of
conversation is desired. This technology has been used successfully to
host tutorial style discussions after the participants have read a prescribed
paper or position. In many cases Chat has been used in conjunction with
email or a web-based learning environment. For example:
“[Chat provides] The ability to conduct a conversation among a group of learners by typing back and forth. For example, a group of human resource managers studying flexible benefit packages may be asked to discuss the advantages and disadvantages of cafeteria benefit plans.” (Driscoll 2001, p 179)

Due to its synchronous nature and conversational style, Chat is a Dialogic technology and is not appropriate for predominately one-way provision of material or as a Representational technology. For the same reasons it is generally not suitable for discussions where learners are required to give deep consideration to their responses. It is suitable for discussions where learners need to develop the skills of “thinking on their feet” and the required conversation style is quick, light and highly interactive. In the Learning Technologies Model (LTM) Chat is clearly a Dialogic technology and as it is text-based technology it has level one attributes. Chat is suitable for activities in the categories of the Learning Activities Model (LAM): Interactions between Learners and Interaction with Facilitator. The analysis of the learning technology, Internet Chat by the Learning Technologies Model (LTM) is shown in Table 6.9.

Internet Chat has been used for some years for social purposes and a chat sub-culture has developed. It has had wide acceptance and large, international groups of enthusiasts have emerged. On occasion some users have become addicted to this form of communication and others have found it a pathway to personal relationships (Parker 1997).
One of the disadvantages of Internet Chat, which is a disadvantage of other communication applications that are text-based or have attributes of level 1, is the ability to watch rather than participate. The term "Lurker" has been coined to describe those who join an Internet Chat session (and other online discussions) but do not participate. One of the advantages of Internet Chat is that the “conversation” is logged on each participant's computer and can be saved for future reference or evaluation of levels of participation.

<table>
<thead>
<tr>
<th>Internet Chat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dialogic, Level 1</td>
</tr>
<tr>
<td>Synchronous</td>
</tr>
</tbody>
</table>

**Learning Activities Model (LAM)**

Suitable categories:
- Interaction Between Learners (IL)
- Interaction with Facilitator (IF)

![Diagram](image)

*Table 6.9. Learning Technologies Model: Internet Chat.*

6.7.6 (c.) Online Discussion.

While similar in many ways, the salient differentiating characteristic between Chat and Online Discussions is that Chat is synchronous and Online Discussions are usually asynchronous. Online Discussion software is basically a virtual space where users can leave messages for other
users to read. Subsequent users of the discussion can either post new messages or respond to existing messages. Hence subsequent users add to the content of the page.

The asynchronous nature of Online Discussions comes about as each learner can choose when to access the discussion and it is generally not expected that users access them at the same time. They are primarily a two-way or Dialogic technology as users can add new messages or respond to existing ones. However, they have a limited capacity to be used as a host for information and in this sense are Representational although practice has shown that their predominant use is Dialogic. For example:

“Discussion allows learners to share information, ideas and feelings among themselves and their instructors. They can establish communication on the basis of shared interest, not merely shared geography.” (Khan 2001, p 81)

In learning contexts, Online Discussions have been used successfully for several purposes. While they are used to host discussions (Khan 2001) they can also be used as a place for the posting of news, announcements and administrative information, such as assignment questions and due dates, exam dates and other important deadlines. Originally Online Discussions were stand-alone applications but the technology has converged with the World Wide Web and most Online Discussions are
now found integrated into web pages (as shown in Figure 6.3) or web-based learning environments.

QuickTime™ and a Photo - JPEG decompressor are needed to see this picture.

**Figure 6.3. Online Discussion: An Example.**

As mentioned earlier, apart from use as announcement tools, the predominant use of Online Discussions in learning is as an asynchronous, two-way conversational tool. Hence in the Learning Technologies Model (LTM) they are a Dialogic technology and as they are text-based they are of level 1 attributes. It follows then that as facilitators and learners can interact using Online Discussions that they support activities in the
categories of the Learning Activities Model (LAM): Interaction Between Learners and Interaction with Facilitator. The analysis of the learning technology, Online Discussion by the Learning Technologies Model (LTM) is shown in Table 6.10.

<table>
<thead>
<tr>
<th>Online Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dialogic, Level 1</td>
</tr>
<tr>
<td>asynchronous</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning Activities Model (LAM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suitable categories:</td>
</tr>
<tr>
<td>Interaction Between Learners (IL)</td>
</tr>
<tr>
<td>Interaction with Facilitator (IF)</td>
</tr>
</tbody>
</table>

Table 6.10. Learning Technologies Model: Online Discussion.

6.7.6 (d). Email and Listservers.

Email (electronic mail) is one of the more common communications applications of the Internet. It is a system for the sending and receiving of messages between networked computers. Usually email is stored on a host or server and as messages are retrieved and responded to by users at their convenience it is asynchronous. When a message is responded to email becomes a two-way or Dialogic technology.
A unique email style of conversation is emerging and generally messages tend to be longer than those in Internet Chat but have more of an informal style than that of printed memos. Email messages are usually limited to text with limited formatting to ensure high-speed communications. However files of any kind can be attached to email messages. While most email programs limit the size of attached files the limit is usually high enough to permit medium to large text files.

Email has been successfully used in learning for messages between learners and between learners and facilitators. Assignment or exam questions can be sent to learners by email and completed assignments can be submitted from distant and local learners as email attachments.

While email is a convenient method for one-to-one communications, it can also be used as device for discussion between members of a group. This can be done in a number of ways. As mentioned earlier in this chapter, Online Discussions can be used for asynchronous discussion and Internet Chat for synchronous discussion. However both of these technologies require the participant to log onto the Chat or discussion space. Email lists allow messages to be distributed to members of a group and hence arrive with the individual’s other email messages. One of the most popular kinds of list technology is the Listserver.

Once a Listserver has been set up it can host many different lists. Open lists can be subscribed to by anyone who owns an email account.
Subscription to closed lists has to be approved by the list owner. Subscription is usually a matter of sending a brief, specific email message to the Listserver program. Once users have subscribed, messages sent to the list are forwarded to all subscribers and generally subscribers who reply to a message on the list have their replies automatically forwarded to all subscribers.

Listservers have been used in learning for many types of discussion in many discipline areas. They can be used to pass information from the facilitator to the learners such as forthcoming television programs or newspaper articles that are pertinent to the course. They can also be used as an alternative or extension to class discussion.

“Discussions started during class time can be continued, unconstrained by allotted airtime and without the costs incurred by long distance telephone connections. Students who can access their E-mail accounts from their homes can work at whatever hour suits them. Students who speak English as a second language can take their time read, with dictionary in hand if necessary, and compose their replies.” (Moore and Kearsley 1996, p 117)

Clearly email and Listservers are appropriate technologies for asynchronous two-way communications and hence are categorised by the Learning Technologies Model (LTM) as Dialogic technologies. As they are text-based they have level 1 attributes. It follows then that when facilitators
and learners use email and listservers that they support activities in the categories of the Learning Activities Model (LAM): Interaction between Learners and Interaction with Facilitator. The analysis of the learning technologies, email and Listservers by the Learning Technologies Model (LTM) is shown in Table 6.11.

<table>
<thead>
<tr>
<th>Email and Listserver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dialogic, Level 1</td>
</tr>
<tr>
<td>asynchronous</td>
</tr>
</tbody>
</table>

**Learning Activities Model (LAM)**

- Suitable categories:
  - Interaction Between Learners (IL)
  - Interaction with Facilitator (IF)

Table 6.11. Learning Technologies Model: Email and Listserver.

6.7.6 (e). Web-Based Learning Environments.

A few years after the arrival of the World Wide Web, Dialogic and Representational functions of the Internet were combined, within the context of the World Wide Web and the first online learning environments were created. Today web-based learning environments combine learning activities with those that permit learners and teachers to track their progress through a course or learning event and are called Learning Management Systems (LMS). The two most popular Learning
Management Systems, Blackboard and WebCT represent the majority of the market and provide learners with a collection of technological elements to use while engaged in Online Learning. The technological elements can be readily divided into those for the process of learning and those for the management of learning. Those for the process of learning can be further subdivided into Representational and Dialogic technological elements.

Table 6.12 shows the Representational and Dialogic technological elements of the Learning Management System, WebCT.

<table>
<thead>
<tr>
<th>Representational</th>
<th>Dialogic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text</td>
<td>Online discussion</td>
</tr>
<tr>
<td>Graphics</td>
<td>Chat</td>
</tr>
<tr>
<td>Audio recordings</td>
<td>Email</td>
</tr>
<tr>
<td>Video recordings</td>
<td></td>
</tr>
</tbody>
</table>

*Table 6.12. WebCT Learning Elements as Representational and Dialogic Technologies (WebCT 2001b)*

Learning Management Systems have enjoyed rapid and wide acceptance in higher education and to a lesser degree in Human Resource Development. Describing itself as “the world's leading provider of e-Learning solutions for higher education” (WebCT 2001b), WebCT claims that over 2,600 institutions in 84 countries are licensed to use its learning environment (WebCT 2001a). This widespread use of Learning Management Systems has been partly responsible for new terms entering the parlance of Higher Education and web-based learning is often referred to as “Online Learning”. As well, Human Resource Development has
adopted new terms such as “eLearning” and “Web-Based Training” to describe the learning with Learning Management Systems (LMS).

As Learning Management Systems consist of technological elements that can be easily differentiated, and as the technological elements can be used individually and are very similar to those used independently of a Learning Management System (LMS), rather than analyse the complete LMS, it is more useful to analyse individual elements. The analysis of the Learning Management System, WebCT by the Learning Technologies Model is then the analysis of the technological elements it is comprised of and is shown in Table 6.13. This analysis draws on the previous analyses of learning technologies that are the same as the technological elements of the LMS.

From the description of WebCT by the Learning Technologies Model it is apparent that the analysis of WebCT is the sum of the analyses of its parts. However, the description is only of some parts of WebCT. It is beyond the scope of this thesis to consider the elements of WebCT that are designed for the management of learning such as the collection or marks and the tracking of student progress through a course.
<table>
<thead>
<tr>
<th>Representational</th>
<th>Dialogic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Text and Graphics</strong>&lt;br&gt;Asynchronous Level 1</td>
<td><strong>Online discussion</strong>&lt;br&gt;Asynchronous Level 1</td>
</tr>
<tr>
<td><img src="image1" alt="Image of text and graphics" /></td>
<td><img src="image2" alt="Image of online discussion" /></td>
</tr>
<tr>
<td>Provision of Material, Interaction with Material</td>
<td>Interaction with Facilitator, Interaction between Learners</td>
</tr>
</tbody>
</table>

| **Recorded Audio**<br>Asynchronous Level 2 | **Chat**<br>Synchronous Level 1 |
| ![Image of recorded audio](image3) | ![Image of chat](image4) |
| Provision of Material, Interaction with Material | Interaction with Facilitator, Interaction between Learners |

| **Recorded Video**<br>Asynchronous Level 3 | **Email**<br>Asynchronous Level 1 |
| ![Image of recorded video](image5) | ![Image of email](image6) |
| Provision of Material, Interaction with Material | Interaction with Facilitator, Interaction between Learners |

*Table 6.13. Learning Technologies Model: WebCT.*

**6.8. Analysis of Technologies and Techniques.**

To assist in the comparison of technologies Table 6.14a and Table 6.14b list a range of learning technologies and techniques that can typically be found in Higher Education and Human Resource Development contexts. Several traditional techniques are listed in the tables as they are often part of Flexible Learning, and as they serve to provide a comparison to learning technologies.
<table>
<thead>
<tr>
<th>Technique or Technology</th>
<th>Learning Technologies Model (LTM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Synchronous/ Asynchronous</td>
</tr>
<tr>
<td>Audio-conference/ Phone</td>
<td>Synchronous</td>
</tr>
<tr>
<td>Audio Tape</td>
<td>Asynchronous</td>
</tr>
<tr>
<td>Email</td>
<td>Asynchronous</td>
</tr>
<tr>
<td>Face-to-Face Consultation</td>
<td>Synchronous</td>
</tr>
<tr>
<td>Face-to-Face Lecture</td>
<td>Synchronous</td>
</tr>
<tr>
<td>Face-to-Face Tutorial</td>
<td>Synchronous</td>
</tr>
<tr>
<td>Facsimile</td>
<td>Asynchronous</td>
</tr>
<tr>
<td>Internet Chat</td>
<td>Synchronous</td>
</tr>
</tbody>
</table>

*Table 6.14a. Analysis of Techniques and Technologies, Part 1.*
### Table 6.14b. Analysis of Techniques and Technologies, Part 2.

The list of learning technologies described in Table 6.14a and 6.14b is not intended to be fixed in time. Indeed as other learning technologies...
become available for use in Higher Education and Human Resource Development, they can easily be added to the tables. As well different organisations and institutions have greater ranges of, preferences for, or investments in, specific learning technologies. In these cases it is appropriate to construct a similar table for the institution or organisation within which the technologies are to be used.

6.9. Conclusion.

The Learning Technologies Model has been developed for two types of purpose. Firstly, to inform the field as a framework for analysis and secondly as a practical device for use in the design of learning events in which technology plays a central role. While the Learning Technology Model represents the juxtaposition of two theoretical approaches relative novices to the process of learning technology analysis and selection can use it. Compared to other conceptualisations of technologies the model links uses of technologies and characteristics of technologies which provides an insight to technology which fosters an approach to the application of technology to learning that promotes new and extended uses of learning technologies. As well the Learning Technologies Model is not fixed in time and hence is not limited to the technologies available at the time of publication and new technologies can be analysed by the model. The Learning Technologies Model (LTM) plays a significant role in the selection of learning technologies and the Technology Selection Method (TSM) which is presented in Chapter Seven.
Chapter 7

A New Method for the Selection of Learning Technologies.

7.1. Introduction.

In the previous chapters the Learning Activities Model (LAM) and the Learning Technologies Model (LTM) Technologies have been developed and exemplified. While these tools are individually useful as they provide theoretical frameworks for analysis of learning activities and learning technologies, they can also be used together in the practical process of the design of learning events and specifically for the selection of learning technologies that are appropriate to the learners, the material, the context and the budget. In this chapter the Technology Selection Method (TSM), an original method, is presented. Examples of the method are provided and it is placed within the context of a generic flowchart for the design of learning events. The Technology Selection Method can also be used in the conversion of existing learning events from traditional, face-to-face techniques to Flexible Learning events.
Traditionally, facilitators of learning events undertake the design of learning events as part of their role. However, in the past when learning technologies were expected to be a central component of the learning process, usually in Distance Education or Open Learning, specialist Instructional Designers typically undertook the design. Currently in Higher Education and in Human Resource Development, where Flexible Learning is burgeoning, many designers of learning events are not equipped to undertake the selection of learning technologies yet there is a growing expectation by management that they undertake this task as part of the design of Flexible Learning events.

The Technology Selection Method (TSM), presented here, is a robust tool for the selection of appropriate learning technologies. It assumes no specialist knowledge in the field of Instructional Design and provides users with an understanding of the technologies as well as the selection process.

7.2. The Selection of Learning Technologies.

In traditionally taught subjects the techniques are often predetermined as seminars, workshops, tutorials, presentations, practicals etc. The technologies are also often limited to traditional classroom technologies, for example, overhead projectors, computer slideshows (such as PowerPoint) and white or blackboards. In Flexible Learning the opportunity exists to select from a range of technologies that in combination will play a central role in the learning event. In Chapter Five, the Learning Activities Model (LAM) was presented and is based on the
premise that the process of learning can be described as provided materials and interactions. In Chapter Six, the Learning Technologies Model (LTM) was presented in which learning technologies are classified as Representational or Dialogic. The Technology Selection Method (TSM) has as its basis, the matching of technologies, as defined by the Learning Technologies Model (LTM), to categories of activities in the Learning Activities Model (LAM). Broadly, Representational technologies are matched to the Provision of Materials and Interaction with Materials categories of the Learning Activities Model (LAM) and Dialogic technologies are matched to the Interaction with Facilitator and Interactions between Learners categories.


As well as matching technologies to activities there are other criteria, sometimes external or peripheral to the process of learning, that must be considered if the selected technologies are to be appropriate for the learners as well as the material, the context and the budget. In Chapter Three it was reported that researchers in the areas of Human Resource Development and Higher Education, generally grouped these criteria into instructional factors, learner factors and cost factors. As these three groups of criteria were found to be common to the technology selection methods reviewed and are congruent with the author's experience they are used, with the extension of learner factors to include facilitator factors, as the categories of criteria that impact on the Technology Selection Method (TSM). These are referred to in this thesis as:

- Mechanics of the subject (instructional factors),
- Learner and facilitator implications (learner factors), and
- Costs (cost factors).

These criteria impact on the selection process and are described in the following sections.

7.3.1. The Mechanics of the Subject.

The Mechanics of the Subject refers to the attributes that are necessary for the efficient and effective communication of the content and interactions of the subject. The attributes required are usually self-evident to the experienced facilitator or designer but as well they can be ascertained through answering questions such as the following. To efficiently and effectively communicate the content:

- Is text necessary or desirable?
- Are black and white graphics necessary or desirable?
- Are colour graphics necessary or desirable?
- Is audio necessary or desirable?
- Is animation necessary or desirable?
- Are moving pictures (movie/video) necessary or desirable?

These fundamental decisions need to be made at the beginning of the selection process and they inform the selection of learning technologies by indicating the characteristics required by the content and interactions of the subject.
7.3.2. Learner Implications and Facilitator Implications.

The use of new technologies places demands on learners and facilitators that need to be taken into account during the selection process as the viability of learning technologies can depend on learners’ access to them and their skills in using them. To ascertain learner implications questions such as the following need to be answered:

- What new skills will learners need to acquire?
- Will the technology cause learners to incur extra costs or buy equipment etc?
- Will learners need access to extra equipment?
- Will learners need training in new study/learning skills?

Many of the learner implications apply to facilitators as well. Where facilitators are expected to design Flexible Learning events they will require training in the appropriate use of learning technologies and in the organisational and practical changes that accompany them.

7.3.3. Costs.

It is obviously essential to ascertain the costs to develop learning technologies. Costs need to be considered in terms of training, production costs and the facilitator’s time. Some learning technologies require much greater preparation times compared to the techniques and technologies of traditional face-to-face learning events.

The following table (Table 7.1) is based on work by Sparkes (1984), Bates (1995) and on the author’s experience in television, radio,
videoconference, World Wide Web development and other learning technologies. The units of the table are the amount of time taken to prepare a traditional one-hour presentation. Obviously some wide generalisations and assumptions have been made but the table does serve to compare and highlight the magnitude of preparation times. The preparation times are indicated as ranges which reflects the wide variety of production values available. For example, putting notes from a presentation on the World Wide Web may add a small amount of time to preparation. However, if a complete, web-based, Learning Management System was used, up to twenty times the preparation time could be anticipated. While this figure appears large it includes the time spent by web programmers and graphic designers.

<table>
<thead>
<tr>
<th>Technique or Technology</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>assume a conventional one hour face-to-face lecture takes</td>
<td>1 unit</td>
</tr>
<tr>
<td>Computer Mediated Communications</td>
<td>2 - 5 units</td>
</tr>
<tr>
<td>Videoconference</td>
<td>5 – 10 units</td>
</tr>
<tr>
<td>World Wide Web</td>
<td>2 - 20 units</td>
</tr>
<tr>
<td>Radio/Audio Cassette</td>
<td>5 – 10 units</td>
</tr>
<tr>
<td>Print</td>
<td>2 - 10 units</td>
</tr>
<tr>
<td>Broadcast Television</td>
<td>10 - 100 units</td>
</tr>
<tr>
<td>Multimedia</td>
<td>50 - 200 units</td>
</tr>
</tbody>
</table>

*Table 7.1. Approximate Preparation Times.*

Table 7.1 indicates preparation times and while it is difficult to arrive at the very general figures in it, it is impossible to state figures for updating material as these vary with many criteria including the shelf-life of the subject area.

7.4. The Technology Selection Method (TSM).

As mentioned earlier the Technology Selection Method is based on the process of matching technologies, as described by the Learning Technologies Model, to categories of the Learning Activities Model (LAM). However, as the three groups of criteria: Mechanics of the Subject, Learner and Facilitator Implications, and Costs will impact on the technologies selected, an iterative process is proposed that takes these groups of criteria into account. The selection method is based on the creation of a description of the proposed learning activities as categorised by the Learning Activities Model (LAM). This description is then matched to all the available learning technologies, as described by the Learning Technologies Model, that are suited to each category of the Learning Activities Model (LAM). Individual technologies are then removed from each category as the other two groups of criteria are considered.

Figure 7.1. Technology Selection Method.
This process is represented graphically in Figure 7.1. The Learning Activities Model (LAM) is shown at the centre of the figure. The categories of the LAM are surrounded by Representational or Dialogic technologies, indicating the relationship between them and categories of the LAM. The groups of criteria, Mechanics of the Subject, Learner and Facilitator Implications and Costs are located outside of the LAM and technologies to indicate that they impact on the process of technology selection.

The following steps are proposed as the iterative process by which the Technology Selection Method (TSM) is used for the selection of learning technologies that are appropriate for the learners, the material, the context and the budget. While the proposed process consists of several iterations the TSM can be used in other ways. For example it can be used to check a particular technology against an individual learning activity or group of them.


In the first step a description of the learning event is created using the categories of the Learning Activities Model (LAM). In the case of a learning event that is being converted from traditional, face-to-face approach to Flexible Learning, the activities that occurred in the traditional event can be used to create the description. In the second step, a short-list of learning technologies is constructed using the list of available learning technologies (Table 6.14a and Table 6.14b). Within each category of the description of the learning event, created in the first step, the learning
technologies are short-listed according to the group of criteria: Mechanics of the Subject. In the third step, the short-list of the learning technologies is then refined, based on the two remaining groups of criteria:

- Learner Implications and Facilitator Implications, and
- Costs.

In the case of learning events that are being converted from traditional to Flexible Learning a fourth step is recommended in which the advantages and disadvantages of the new version of the learning event are compared with the old version.

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Use the categories of the LAM to describe the event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2</td>
<td>List all technologies appropriate for the Mechanics of the Subject within each category of the LAM</td>
</tr>
<tr>
<td>Step 3</td>
<td>Refine list of technologies based on Learner and Facilitator Implications and Costs</td>
</tr>
<tr>
<td>Step 4.</td>
<td>Compare advantages and disadvantages where possible</td>
</tr>
</tbody>
</table>

Table 7.2. The Steps in the Technology Selection Method (TSM).

The steps in the selection process are shown in Table 7.2 and the following fictitious examples are provided to illustrate and further explain the process of the Technology Selection Method (TSM).


An undergraduate humanities subject that has been taught on-campus for some years is to be converted to Flexible Learning. The subject has been taught traditionally using a mixture of lectures and seminars. In the past learners were divided into twelve groups and each group selected a seminar topic, prepared and presented a paper on it. After the
presentation of the seminar paper the whole class would discuss it. The assessment of the traditionally taught subject consisted of the group seminar paper, individual participation in the seminar discussions, a minor essay and a major essay. It was decided to create a Flexible Learning version of the subject so that students who were dispersed geographically would be able to participate in it without travelling to campus, thus affording the subject some increased flexibility in terms of where and when students study. A description of the traditionally taught subject was created using the categories of the Learning Activities Model (LAM) and is shown in Table 7.3.

<table>
<thead>
<tr>
<th>LAM Category</th>
<th>Description</th>
<th>Technologies</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction with the Facilitator</td>
<td>Face-to-face in lectures and seminars. Face to face consultation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction between Learners</td>
<td>Face-to-face group work leading to presentation of seminar paper. Face-to-face discussion in seminars. Informal on-campus or off-campus.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intra-action</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 7.3. Example 1, Technology Selection Method: Step 1.*
At this stage, the Intra-action category has intentionally been left empty as activities in this category cannot be prescribed and are dependent on factors controlled more by learners than the designer or facilitator of the learning event. However, the category is included as reminder to the designer that it is a salient category of learning activities and that the designed learning event should lead to activities in it.

In the second step a short-list of learning technologies was created from the list of available learning technologies (Table 6.14a and Table 6.14b) on the basis of the group of criteria: Mechanics of the Subject. In this example it was assumed that some limited colour graphics were needed as well as text for activities in the LAM categories: Provision of Material, and Interaction with the Material. It was also assumed that some limited face-to-face interaction was preferable for activities in the LAM categories: Interaction between Learners and Interaction with the Facilitator, although the majority of these interactions could occur effectively with text only (for example, by the Dialogic technologies of Level 1 such as Chat, Online Discussion and email).

The list of available learning technologies indicated that the technologies that were suited to the categories of Provision of Material, and Interaction with Material were print, video, and World Wide Web. Likewise the list of available technologies indicated that the options for Interactions between Learners were videoconference and Listserver. For the category: Interaction with the Facilitator, the options indicated were email and
phone. As well, the videoconferences would provide opportunities for Interaction with the Facilitator. This step is shown in Table 7.4.

<table>
<thead>
<tr>
<th>LAM Category</th>
<th>Description</th>
<th>Technologies</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction with Material</td>
<td>Textbook. Library books. Lecture notes and handouts.</td>
<td>print video World Wide Web</td>
<td></td>
</tr>
<tr>
<td>Interaction with the Facilitator</td>
<td>Face-to-face in lectures and seminars. Face-to-face consultation.</td>
<td>email phone fax videoconference Listserver</td>
<td></td>
</tr>
<tr>
<td>Interaction between Learners</td>
<td>Face-to-face group work leading to presentation of seminar paper. Face to face discussion in seminars. Informal on-campus or off-campus.</td>
<td>email videoconference Listserver</td>
<td></td>
</tr>
</tbody>
</table>

Table 7.4. Example 1, Technology Selection Method: Step 2.

In the third step, the short-list of technologies was refined in consideration of the groups of criteria: Learner and Facilitator Implications and Costs. Technologies that have student or staff implications that cannot be met or options that are too expensive were ruled out. For example, it was found that video production was too expensive and as all students (in this example) had easy access to the Internet, the World Wide Web was chosen as the primary technology for the categories of Provision of Material and Interaction with the Material in preference to video.

One of implications for the facilitator considered in this example was the change in consultation from face-to-face to email and phone. Traditionally, the hours of the facilitator’s availability for face-to-face consultation (without an appointment) were limited to those advertised (usually on their office door). Changing this to the phone and email can make the imposition of time limitations difficult and has the potential to lead to changes in workload.

In the Interaction between Learners category it was decided to use videoconference on only one or two occasions during the course of the subject as it necessitated students meeting at the videoconference studio at a given time, hence reducing flexibility of time and place of learning. It was decided to use a Listserver as the main technology for this category of the Learning Activities Model (LAM). Opportunities for the group to interact with the facilitator were possible during the videoconferences however, as all learners in the example had ready access to the Internet, email was selected as the primary technology for individual Interaction with the Facilitator with phone being used as back up or for use in special instances.

The refined list of technologies is shown in Table 7.5. When the decisions about techniques and technologies for each category had been reached, the advantages and disadvantages were considered for each category of the Learning Activities Model (LAM). It was considered that one disadvantage might be the lack of a human face, or the reduction in the
attributes of the dialogue in the categories of Interaction between Learners and Interaction with the Facilitator.

<table>
<thead>
<tr>
<th>LAM Category</th>
<th>Description</th>
<th>Technologies</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction with Material</td>
<td>Textbook. Library books. Lecture notes and handouts</td>
<td>World Wide Web</td>
<td></td>
</tr>
<tr>
<td>Interaction with the Facilitator</td>
<td>Face-to-face in lectures and seminars. Face to face consultation.</td>
<td>email phone fax</td>
<td></td>
</tr>
<tr>
<td>Interaction between Learners</td>
<td>Face-to-face group work leading to presentation of seminar paper. Face-to-face discussion in seminars. Informal on-campus or off-campus.</td>
<td>listserver videoconference</td>
<td></td>
</tr>
</tbody>
</table>

Table 7.5. Example 1, Technology Selection Method: Step 3.

This arose as email (Level 1 attributes) and phone (Level 2 attributes) were the main technologies in these categories and learners and the facilitator would only meet, face-to-face, by videoconference on one or two occasions. However, in this example this disadvantage could be adequately offset by the advantages of flexibility of time and place of learning. Often Flexible Learning subjects are characterised by comparisons or “trade-offs” like this. The advantages and disadvantages are shown in Table 7.6.

If the advantages and disadvantages are acceptable to the facilitator or designer the process of technology selection is complete. If not, another iteration of the last three steps needs to be undertaken.

<table>
<thead>
<tr>
<th>LAM Category</th>
<th>Description</th>
<th>Technologies</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction with Material</td>
<td>Textbook. Library books. Lecture notes and handouts</td>
<td>World Wide Web</td>
<td></td>
</tr>
<tr>
<td>Interaction with</td>
<td>Face-to-face in lectures. Face-to-face in seminars. Face to face consultation.</td>
<td>Email phone fax</td>
<td>Face-to-face interaction limited.</td>
</tr>
<tr>
<td>Facilitator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction between</td>
<td>Face-to-face group work leading to presentation of seminar paper. Face to face discussion in seminars. Informal on-campus or off-campus.</td>
<td>Listserv conference</td>
<td>Face-to-face interaction limited.</td>
</tr>
<tr>
<td>Learners</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7.6. Example 1, Technology Selection Method: Step 4.


In the second example, employees of an organisation, located at the head office and several branch offices, are required to become competent in a recently acquired software package. The branch offices are far apart and far from the head office making travel to a central location expensive in travel costs and time away. However, the branch offices are linked to each other and the head office by videoconference. To adequately train
employees it is planned to use materials, demonstrations, discussions, group and individual work and consultation with the facilitator.

The first step in the Technology Selection Method (TSM) is to create a description of the planned subject using the categories of the Learning Activities Model (LAM). In this step it was considered that the activities in the Provision of Materials would be:

- a prescribed book supplied by the company and delivered to each trainee,
- reference books held in the company library, and
- a collection of information distilled from articles and books in the facilitator's own personal collection.

The facilitator was the designer of the learning event as well and considered that learners would interact with the materials and trial the software after reading sections of the text, references and other information. This interaction could take place in the workplace or at home if learners have access to the necessary equipment. The designer considered the following activities for the category of the Learning Activities Model (LAM): Interaction with the Facilitator.

- Demonstration of the software,
- Presentation of material,
- Consultation, and
- Feedback given in respect of submitted assignments.

In the Interaction between Learners category, the designer considered some group discussion as well as group work on projects to be desirable.
The designer of the learning event also considered informal discussion between learners to be beneficial to the achievement of the desired learning outcomes. The first step in the Technology Selection Method (TSM) is the description of the subject and is shown in Table 7.7.

<table>
<thead>
<tr>
<th>LAM Category</th>
<th>Description</th>
<th>Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction with the Facilitator</td>
<td>Demonstrations of software. Individual consultation. Assessment.</td>
<td></td>
</tr>
<tr>
<td>Interaction between Learners</td>
<td>Group work on project. Group discussion. Informal discussion</td>
<td></td>
</tr>
<tr>
<td>Intra-action</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7.7. Example 2, Technology Selection Method: Step 1.

In the second step learning technologies were selected from the list of available technologies (see Table 6.14a and Table 6.14b) on the basis of consideration of the group of criteria, Mechanics of the Subject. These are shown in the third column in Table 7.8. As the facilitator was located at head office they could provide material through presentations to learners also at the head office. However, it was decided, where possible, to provide the same learning experiences at both the branch and the head
offices. Apart from issues of equity this would be beneficial as all learners
could be assessed using the same tests and communication between the
groups could enhance the learning experience for all.

<table>
<thead>
<tr>
<th>LAM Category</th>
<th>Description</th>
<th>Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction between Learners</td>
<td>Group work on project. Group discussion. Informal discussion</td>
<td>face to face videoconference. email. fax. phone.</td>
</tr>
<tr>
<td>Intra-action</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 7.8 Example 2, Technology Selection Method: Step 2.*

It was decided that learning technologies for Provision of Material, and Interaction with the Material needed to be capable of displaying changing computer screens of the software, hence video and World Wide Web were considered in conjunction with print for the background material. Interaction between Learners at the same location would be face-to-face while interactions between offices and Interaction with the Facilitator would occur by videoconference, email, phone and fax.
In the third step the list of learning technologies was refined when the groups of criteria: Learner and Facilitator Implications and Costs were considered. As most reference material was located at the head office it was decided to prepare study guides and reprints of articles to distribute to learners. Along with the prescribed book these formed the print component of the provided materials. The facilitator/designer considered video too expensive for the provision of materials as it was known that the shelf-life of the material was limited with major updates to the software each year. It was decided to provide the dynamic display of software by the Internet as learners can access the Internet in the workplace. This would be achieved through still images of monitor screens in World Wide Web pages which would also be used for messages and as a directory for downloadable files.

As all the offices are connected by a videoconference it was decided to use videoconference as the primary technology for Interaction with the Facilitator, and Interaction between Learners. It was decided that individual contact with the facilitator would be by email and that the facilitator would aim to reply to learners’ messages within two working days. Formal, face-to-face interaction between learners would take place at each office and the videoconference would facilitate interaction between offices, thus permitting synchronous learning at all offices. As learners were required to complete a group project it was expected that groups would be formed at each office. However, it was anticipated that should
the need arise, a group consisting of learners from a number of offices, facilitated by videoconference, could be considered. The third step of technology selection, using the Technology Selection Method (TSM) is shown in Table 7.9.

<table>
<thead>
<tr>
<th>LAM Category</th>
<th>Description</th>
<th>Technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction between Learners</td>
<td>Group work on project. Group discussion. Informal discussion</td>
<td>Face-to-face. Videoconference. email.</td>
</tr>
<tr>
<td>Intra-action</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 7.9. Example 2, Technology Selection Method: Step 3.*

As Intra-action was considered to depend in large part on the degree to which the other categories stimulated and encouraged learners to achieve the desired learning outcomes it is not shown. As the learning event was new there was no valid comparison event and hence the fourth step of the Technology Selection Method (TSM) in which advantages and disadvantages are listed could not be undertaken.
These two fictitious examples have been provided to assist in the description of the steps in the process of the selection of learning technologies using the Technology Selection Method (TSM). Further examples of learning events that have been designed by the Method have been included in Appendix One.

7.8. The Technology Selection Method (TSM) and Approaches.
As mentioned earlier, the Technology Selection Method has been developed for use by designers who do not have specialist Instructional Design knowledge or skills and as the designer of the learning events will often be the facilitator of the same events several benefits are to be gained. Firstly, the process of technology selection is informed by the experience of facilitator/designer as the knowledge they have gathered through prior facilitation experience can be used to inform the process. In this way some pitfalls can be avoided and effective approaches maintained. This experience would be incorporated into the first step in the Technology Selection Method in which a description of the proposed learning event is created. Secondly, as the method is designed for use by facilitators there should be benefits from the proximity of the design process to the facilitation of the learning event. Hence allowing facilitators to “own” the process of design. As well, first hand feedback is available to refine the mix of technologies and activities.

The process of selecting learning technologies provides a natural opportunity for facilitators to reflect on their practice as well as their

approach to the facilitation of learning. Within the Higher Education field there has recently been a groundswell of opinion among education theorists and commentators that constructivism is desirable as an educational approach or philosophy. In the field of Human Resource Development constructivism is not as popular and sometimes a more instructive approach is advocated for reasons of cost and time constraints. Roblyer and Edwards describe constructivism and “Direct Instruction” as addressing different needs.

“Needs addressed by Direct Instruction

1. Individual pacing and remediation, especially when teacher time is limited.
2. Making learning paths more efficient (eg., faster), especially for instruction in skills that are prerequisite to higher-level skills.
3. Performing time-consuming and labour-intensive tasks (eg, skill practice), freeing teaching time for other, more complex student needs.
4. Supplying self instructional-sequences, especially when human teachers are not available, teacher time for structured review is limited, and/or students are already highly motivated to learn skills.

Needs Addressed by Constructivism

1. Making skills more relevant to students’ backgrounds and experiences by anchoring learning in meaningful, authentic (eg., real-life) highly visual situations.
2. Addressing motivation problems through interactive activities in which students must play active rather than passive roles.

3. Teaching students how to work together to solve problems through group-based cooperative learning activities.

4. Emphasising engaging motivational activities that require higher-level skills and pre-requisite lower-level skills at the same time”.

(Roblyer and Edwards 2000, p 51)

Clearly the approaches address different learning needs and contexts. In Human Resource Development where management wishes to see a return on the investment the organisation has made in training, the efficiencies associated with “Direct Instruction” could favour that approach. Conversely, in Higher Education where return in investment is not as high a priority, other motivating factors may take precedence. A full discussion of Direct Instruction, constructivism and other approaches to learning is relevant to the selection of technologies but is beyond the scope of this thesis. However, a brief discussion of these approaches and the Learning Activities Model and the Technology Selection Method follows.

As well as in the first step of the Technology Selection Method the Learning Activities Model (LAM) can be used as a means of unpacking a current learning event and to predict a new mix of activities if the event was to be moved to a different approach. It is likely that a learning event, characterised by Direct Instruction, would have many activities in the LAM categories of Provision of Material, and Interaction with Material and fewer
activities in the categories of Interaction with Facilitator, and Interaction between Learners. As the Categories Provision of Materials and Interaction with Materials are matched to Representational learning technologies in the Technology Selection Method (TSM) it could reasonably be expected that Direct Instruction learning events would be characterised by more Representational than Dialogic technologies.

By contrast it is likely that a subject characterised by constructivism while having some activities in the LAM categories of Provision of Material, and Interaction with Material would have a predomination of activities in the categories of Interaction with Facilitator, and Interaction between Learners. As the categories Interaction with the Facilitator and Interaction between Learners are matched to Dialogic learning technologies in the Technology Selection Method (TSM) it could reasonably be expected that constructivist learning events would be characterised by more Dialogic than Representational technologies.

The Technology Selection Method (TSM) presented here does not prescribe or proscribe any educational approach or philosophy. Rather the method allows the learning designer the freedom to use the approach or philosophy of their choice and provides an excellent and timely opportunity to move the learning experience they are designing towards or away from a particular approach.


The selection of learning technologies usually occurs as part of the wider process of the design of learning events. In Chapter One, models of Instructional Design were discussed and the location of the selection of technology in the design process was indicated.

Often the first step in the design is a decision to offer a learning event. The next steps are the development of objectives of the learning event and the creation of a profile of the potential learners. While these three areas are shown one after the other in the flowchart (Figure 7.2), it is anticipated that there would be high levels of feedback between each step so that the learning event will meet the expectations of the institution or organisation and learners. The selection of technologies is shown as occurring after the content has been decided upon and the outline of the learning event written. Like other components of the design process it is not suggested that, once the technology decisions have been made, they are fixed and cannot be reviewed. It is suggested that as more information on the other elements of the design become available the selected technologies should be re-evaluated and changed if necessary.

Figure 7.2. A Generic Design Flowchart.
7.10. Conclusion.

The Technology Selection Method (TSM) has been developed and is presented for use by designers of learning events in Higher Education and in Human Resource Development. The method draws on the two theoretical frameworks developed in earlier chapters: The Learning Activities Model (LAM) (Chapter Five) and the Learning Technologies Model (LTM) (Chapter Six). The Technology Selection Method is based on matching categories of the Learning Activities Model (LAM) to technologies as described by the Learning Technologies Model (LTM). The Technology Selection Method is a four-step, decision-making process. The first step uses the Learning Activities Model (LAM). The second and third steps consider the groups of criteria: Mechanics of the Subject, Learner and Facilitator Implications and Costs to select learning technologies.

The Technology Selection Method (TSM) has been developed in response to the growing number of facilitators and designers of learning events in Higher Education and Human Resource Development who have little or no experience in the design of learning events that incorporate learning technologies other than as adjuncts. To this end, the Technology Selection Method is characterised by simplicity of use, yet is robust and is effective in a wide number of subject areas. As well the method has been developed to operate within the philosophy and approach of the designer of the learning event. It can be used in the design of constructivist learning, direct instruction or any other approach. The method can also be
used as a tool to assist in the changing of the approach or philosophy used in a particular learning event.

The Technology Selection Method (TSM) does not simply prescribe technologies, rather it allows designers to explore technological options and provides them with an insight to the characteristics of each technology. In this way the potential to extend the use of technology in learning is fostered. The Technology Selection Method is presented as a way to include learning technologies in learning events that are appropriate to the learners, the material and the context and the budget.
Chapter 8

Conclusion.

8.1. Introduction

In the space of a few years the Internet and in particular the user-friendly capabilities of the World Wide Web have been adopted by a large number of organisations and institutions, as a central technology for learning in Higher Education and in Human Resource Development. While estimates of Internet usage for learning in these contexts vary, they all agree that the level of investment in Internet equipment and infrastructure is significantly large and that it will grow for the next few years at least.

“In 2001, 40% of faculty members at two- and four-year higher education institutions in the USA used the web to host course related information … the United States corporate e-Learning market is expected to surpass $US23 Billion by 2004.” (Meyer 2002, p 6)

The World Wide Web is a developing technology. When web pages were first used they were restricted to text and static graphics but in the past
few years this has evolved into a collection of Representational and Dialogic technologies. Representational web pages can now contain text, animated graphics, streamed video and audio, interactive Multimedia and links to downloadable files in any format. As well, the web has hosted the Dialogic applications of Online Discussions, Chat and email for some time. One of the more recent developments is editable or collaboratively built web pages that can be edited or built through the use of web forms and rebuilt automatically as they are driven by a database (Caladine 2002).

Today the web is better described as a host for many technologies, rather than a single technology, and in many cases web applications are grouped into portals or environments.

At the end of the twentieth century terms such as “Online Learning”, “Technology-Based Training”, “eLearning” and many others were being used to describe the use of Internet technologies in learning. The adoption of Internet-based learning technologies has been widespread and rapid and has happened for many reasons. For some Higher Education institutions it was a response to the need for greater efficiency in a climate of shrinking funding or to provide learning opportunities to those marginalised by distance or commitments to work or family. For some Human Resource Developers it was to increase the effectiveness and efficiency of learning. For some organisations and institutions it was a natural reaction to the changing profile of their learners and for many others it was a combination of these reasons. Clearly, in many cases, the increased use of learning technology has changed the nature of learning.
and has better served the needs of learners, organisations and institutions through flexibility of time and place of learning. Gonick, an advocate of learning technologies, argues that technology-based learning compares favourably with other approaches.

“…we evaluate it [a new learning technology] against our overall campus values that include providing students and faculty with innovation, access, flexibility, convenience and accommodation of diverse learning styles.” (Gonick, 1999)

At first, like most innovations, learning technologies were adopted by a few individuals, or early adopters, and in most cases were supported by Instructional Designers or Media Specialists. Now that the use of the Internet in learning has moved into the mainstream, facilitators are required to design learning events that incorporate learning technologies as central components of them. The learning technologies can include: print, audio, video, videoconference, Multimedia, Chat, Online Discussion, email, Listservers and others, many of which can be stand-alone applications or combined into web-based learning environments. While facilitators are used to designing learning events that successfully use presentations, workshops, tutorials, seminars, demonstrations and laboratory classes, most facilitators do not have the Instructional Design skills necessary to ensure the appropriate use of learning technologies when they play a central role in the events they design.
Designers of learning events need simple tools to assist them in the practical design of learning events that make use of learning technologies in a manner that is appropriate to the learners, the material, the context and the budget. As well new conceptualisations of learning activities and learning technologies that can be used analytically are needed to foster understanding of, and for further research into technology-centred learning events. This thesis presents two original theoretical frameworks, one of learning activities and the other of learning technologies.

Many have written about the selection of technology. In the literature a number of models of Instructional Design have been put forward that include steps in which technologies are selected. Other commentators propose lists of factors to consider when selecting technologies. In Organizational Communications a number of theories and methods for the selection of technology have been reported. In each case the proposed method, model or list of factors for the selection of technologies is deficient or not appropriate for the needs of designers of learning events in Higher Education and Human Resource Development. The technology selection methods in the literature of Organizational Communications generally only cater for two-way communications and hence are not applied to Representational technologies. The technology selection methods in the literature of Instructional Design are not appropriate for designers who are not specialists in the Instructional Design field. The Instructional Design methods assume a depth and breadth of knowledge and understanding specific to Instructional Designers. The technology selection methods
reported in the Higher Education literature can be categorised as either those designed to select technologies that are intended to be adjuncts only to the learning process or those for selecting technologies as central components of a learning event. However, the latter group is generally under-conceptualised and under-theorised and hence does not facilitate understanding of the technology selection process. Facilitators of learning, already busy with their normal duties, need design tools that are simple enough to be used in the absence Instructional Design expertise while still being effective. The tools also have to be robust enough to be used in a variety of subject areas with successful outcomes.

The two original theoretical frameworks presented in this thesis are brought together to form a method for the selection of learning technologies. The first theoretical framework provides designers of learning events with a clear analysis of the elements of a planned or existing learning event through categorisation of activities. The second theoretical framework categorises learning technologies according to their communicative attributes and whether they are one-way, Representational, technologies for the provision of material or two-way, Dialogic, technologies. As well the framework indicates the categories of learning activities to which particular learning technologies are inherently suited. Through a process of matching categories of the two theoretical frameworks, a method for the selection of learning technologies that are appropriate to the material, the learners, the context and the budget is developed. The frameworks and method are entitled:
8.2. Learning as Provided Materials and Interactions.

To develop the theoretical framework of learning activities: The Learning Activities Model (LAM), evidence was sought to support the notion that the activities of the learning process can be divided into those for the provision of materials and those for interactions. The literature of several related fields was investigated. In particular the Distance Education literature was appropriate as many of the technologies now used in learning were originally used only in Distance Education. Taylor (2001) describes Flexible Learning as the “fourth generation” of Distance Education and a logical evolution of it. Taylor’s table entitled “Models of Distance Education: A Conceptual Framework” (reproduced in Chapter Two) provides tacit support for the notion as it describes each generation in terms of flexibility as well as in terms of:

- “Highly Refined Materials” or one-way technologies, and
- “Advanced Interactive Delivery” or two-way technologies.

As well Bates (1995) refers to learning technologies as being one-way or two-way. He argues that with one-way technologies learners interact with materials and that two-way technologies are for interactions between humans. Further corroboration is provided by Rowntree (1994) who lists four categories of learning technologies as: print, audio/visual, practical or human interaction.
8.3. The Learning Activities Model (LAM).

The Learning Activities Model (LAM) is a theoretical framework that categorises the activities in the process of learning. It was developed for theoretical and practical applications. The LAM is a new conceptualisation of learning activities that can be used analytically to further research in this area. As well the LAM has been developed to assist designers of learning events by categorising the activities of the learning process and thereby it provides a framework for the consideration of techniques and technologies for each category. It is based on the notion that the learning process can be described as provided materials and interactions. It further subdivides interactions into the categories of: Interactions with Materials, Interactions with the Facilitator (of learning), Interactions between Learners, and Intra-action, a term coined by the author to describe those activities not in the other categories. The Learning Activities Model (LAM) is represented graphically in Figure 8.1.

PM – Provision of Materials
IM – Interaction with Materials
IF – Interaction with Facilitator
IL – Interaction between Learners
IA – Intra-action

*Figure 8.1. The Learning Activities Model (LAM).*
As an analytical or practical device the Learning Activities Model has a number of uses. It forms part of the new technology selection method presented in this thesis and as well can be used as a stand-alone theoretical framework. For example the model provides a framework for the description of learning events in which activities within each category may be listed for the analysis of a learning event. An example of this type of use is provided in Appendix One.

8.4. The Learning Technologies Model (LTM).

The second theoretical framework, the Learning Technologies Model (LTM), has been developed in two stages. In the first stage learning technologies are categorised in two dimensions. As the Learning Activities Model (LAM) is based on the premise that the activities of learning can be divided into the one-way provision of materials and two-way interactions, the first stage of the Learning Technologies Model (LTM) reflects this and divides technologies into two categories, Representational and Dialogic. Representational technologies are one-way, represent things, concepts, ideas etc and are characterised by the one-way flow of information from the technology to the user. Examples include: print, static web pages and videotapes. Dialogic technologies are two-way and facilitate dialogue between humans. Examples include: telephone, email and Internet Chat. Within each of these categories, technologies are further classified into three levels according to the communication attributes they support. For example, email is classified as a Dialogic technology and as it is predominantly used for communications in text is described as having
level one attributes, that is, text only. The telephone is also a Dialogic technology but has level two attributes as vocal characteristics can be used as well as the words or text as communicative cues or devices. Videoconference is another Dialogic technology but of level three attributes, as non-verbal cues such as body language are available as well as vocal characteristics and text. The basis of the Learning Technologies Model (LTM) is shown graphically in Table 8.1.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Representational</th>
<th>Dialogic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Text and still images eg printed material</td>
<td>Text only eg email</td>
</tr>
<tr>
<td>Level 2</td>
<td>Voice and Other audio eg radio broadcast, audio tape</td>
<td>Voice only eg telephone</td>
</tr>
<tr>
<td>Level 3</td>
<td>Voice and moving pictures eg movie or video tape</td>
<td>Voice and image eg video-conference</td>
</tr>
</tbody>
</table>

*Table 8.1. The Basis of the Learning Technologies Model (LTM).*

In the second stage of development, the Learning Technologies Model (LTM) is extended by the addition of two further criteria. Firstly the criterion of the synchronous or asynchronous nature of each technology is added to provide a more exact description. Secondly the criterion of the categories of the Learning Activities Model (LAM) to which individual technologies are inherently suited is added.

The Learning Technologies Model (LTM) can be used as an analytical guide to learning technologies and provides an indication of their
appropriate use. A graphical representation of the LTM is shown in Figure 8.2.

The Learning Technologies Model (LTM) can be used as a theoretical framework of future as well as current learning technologies. Indeed as other learning technologies become available for use in Higher Education and Human Resource Development, they can easily be analysed by the model. As different organisations and institutions have greater ranges of, preferences for, or investments in, specific learning technologies it is appropriate to construct a table containing the analyses of the technologies (such as Table 6.14a and Table 6.14b) for each institution or organisation.

A selection of common learning technologies has been analysed by the Learning Technologies Model (LTM) to exemplify its use and to
demonstrate how other learning technologies may be classified within this theoretical framework. One of the strengths of the LTM is that it is sufficiently broad to describe all learning technologies, or elements of them, yet provides users with an insight to the characteristics of individual technologies.

8.5. The Technology Selection Method (TSM).

The original method, The Technology Selection Method draws on the first two frameworks. The TSM is a method that matches the notion, that the process of learning can be described as provided material and interactions, with the division of learning technologies into Representational and Dialogic categories as shown in Figure 8.3.

![Figure 8.3. Graphical Representation of the Basis of the Technology Selection Method.](image-url)
The Technology Selection Method (TSM) is a four-step process that guides designers of learning through the technology selection decision-making process. The steps are outlined in Table 8.2.

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Use the categories of the LAM to describe the event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2</td>
<td>List all technologies appropriate for the mechanics of the subject within each category of the LAM</td>
</tr>
<tr>
<td>Step 3</td>
<td>Shorten list of technologies based on learner and facilitator implications, Costs and other criteria</td>
</tr>
<tr>
<td>Step 4</td>
<td>Compare advantages and disadvantages where possible</td>
</tr>
</tbody>
</table>

*Table 8.2. The Steps in the Technology Selection Method (TSM).*

The Technology Selection Method is simple yet robust. It is simple enough to be used by designers of learning events who have little or no expertise in Instructional Design or skills in the selection of technologies as central components of learning events. As well the method is robust in that it can be applied in the fields of Higher Education and Human Resource Development across the broadest range of subject areas. Examples of the use of the Technology Selection Method can be found in Appendix One.

8.6. Changes to the Nature of Work.

As mentioned earlier, the use of technology as a major component in learning is burgeoning and it can be assumed, by the levels of investment already made in capital and infrastructure, that this will be the case for the foreseeable future. This increase in the use of learning technologies is reflected in changes in the nature of the work of facilitators and designers of learning events, not only during the design process but during
facilitation as well. The provision of adequate resources and changes to policies are essential if high quality learning experiences are to be maintained. Issues that must be addressed include:

- the need for training and staff development,
- concerns over fragmentation of the workforce,
- changes to workloads, and
- ownership of intellectual property and copyright.

For the design of efficient and effective learning events by teachers and trainers, staff development or training in the design process is necessary. Designers of learning events need to have ready access to the resources needed for the design process and the tools developed in this thesis require vehicles for their dissemination. This could be achieved by face-to-face seminars or workshops or through the use of learning technologies such as the World Wide Web, print or others.

For some time, management has encouraged the use of learning technologies as major components of learning events due to the efficiencies that are potentially available. For example it may cost less to fragment the process of the design and facilitation of learning by employing one person to create the content, others to interact with the learners and yet others to assess learners. While there may be clear financial advantages to this approach, it may not be cost-effective if the quality of the learning experience is decreased by a fragmentation and divorce from expert knowledge.
Workloads of facilitators may change due to the changes in the nature of work when learning technologies are used as major components of learning events. While the flexibility of time and place of learning is advantageous to learners, it can impact on the amount of time facilitators spend designing, presenting and interacting with learners. Compared to face-to-face learning where there generally are designated times for interaction with the facilitator, and as some dialogic learning technologies are asynchronous, communications from learners can reach the facilitator at any time hence making the imposing of time limits on these tasks difficult and possibly in conflict with good teachers’ desire to respond promptly to learners’ enquiries.

The question of ownership of intellectual property is generally confined to Higher Education as in Human Resource Development, intellectual property in the learning materials is generally clearly defined as either, owned by the organisation or is purchased or licensed to them. In Higher Education the academic who generated it has traditionally owned intellectual property.

“Traditionally academics have owned the intellectual property in the course materials they create. However, with online learning many institutions are claiming that they should own it as they provide the facilities and infrastructure that make online learning possible.”

(Caladine 2001, p 1)
As many learning technologies require considerable investment by the organisation or institution, managers looking for a return on this investment are in some cases questioning the ownership of intellectual property by academics and in others demanding that it be retained by the institution. Such changes need to be made carefully, with adequate consultation and the resulting policies must be visible and available to all subsequent designers of learning.

8.7. Further Investigations.

The nature of the theoretical frameworks: the Learning Activities Model (LAM), the Learning Technologies Model (LTM), and the Technology Selection Method (TSM) is such that they are not limited to use with current technologies. It is anticipated that forthcoming technologies will be able to be analysed by the LTM and matched to activities in the LAM through the TSM and that changes to the theoretical frameworks will not be required for the foreseeable future. However, there are other areas in which use of the theoretical frameworks could be extended. For example the Learning Activities Model (LAM) could be used to compare cultural differences in similar learning events through the comparison of levels and types of activities within each of its categories. As many web-based learning environments include learning management tools to the extent that they are often referred to as Learning Management Systems (LMS), another area of further investigation might consider the extension of the
Learning Activities Model (LAM) and the Learning Technologies Model (LTM) to include and represent the management of learning.

The Learning Activities Model, the Learning Technologies Model and the Technology Selection Method have been developed as analytical devices for use in the research and practice of learning events in Higher Education and Human Resource Development. They have also been developed to assist designers of learning events in the selection of learning technologies that are appropriate to the learners, the material, the context and the budget.
References.

Ackerman, J. (1972) *Operant Conditioning Techniques for the Classroom*  
Teacher Scott, Foresman and Company: Illinois


Caladine, R. (2002) CUPIDs: *Collaborative, User-Produced internet Documents.* An application (successful) for funding from the Educational Strategies Development Fund of the University of Wollongong (internal document)

Caladine, R. (2002a) *A Discussion Paper on the Use of Multimedia Streaming for Learning at the University of Wollongong* (internal University of Wollongong publication)


References.

CEDIR (Centre for Educational Development and Interactive Resources).

Accessed 18 March, 2003


Harcourt Brace Jovanovich College: Fort Worth


References.


Lee, W. and Owens (2001) *A Systematic Approach to Media Selection.* ASTD learning Communities (online)
http://www.astd.org/virtual_community/Comm_elrng_rdmmap/whitepapers.html


Higher Education Sector in Australia.  Occasional Papers Series DEET Higher Education Division.  AGPS: Canberra


Moore, M and Kearsley, G. (1996) *Distance Education a Systems View* Wadsworth: Belmont


References.


Race, P. (1992) 53 Interesting Ways to Write Open Learning Materials Technology Education Services: Bristol


References.


University Of Wollongong (1996) *University Of Wollongong (Academic Staff)*

*Enterprise Agreement, 1996 To 1999 Between University Of Wollongong and National Tertiary Education Industry Union.*


Appendix 1

Application of the Learning Activities Model, the Learning Technologies Model and the Technology Selection Method.

A1.1. Introduction.

The theoretical frameworks and method developed in this thesis, The Learning Activities Model (LAM), The Learning Technologies Model (LTM), and the Technology Selection Model (TSM), have been used in a number of different instances and contexts. They have been used in the redesign existing learning events to incorporate learning technologies as central components and they have been used to clarify and specify the appropriate roles of individual technologies in learning. The author has presented the models and methods in numerous staff development workshops at the University of Wollongong. As well the author has presented guest lectures based on the models and method to undergraduate students in the Department of Management and the School of Information Technology and Computer Science. The author was invited...
to present the models and method at the University of Newcastle and the Energy Training and Development Services organisation. The following examples are presented as evidence of the practical application of the models and method and of their use in the processes of analysis and selection of learning technologies that are appropriate to the material, the learners, the context and the budget.


The Learning Activities Model (LAM) has been, and continues to be used widely in the process of the design of learning events at the University of Wollongong and provides a starting point for the design process. It is often used as a worksheet on which the existing or planned details of the learning event are entered. Figure A1.1 is an example of a Learning Activities Model (LAM) worksheet.

The Learning Activities Model (LAM) has also been used in the analysis, and recommendations for the use of new learning technologies. Two of the learning technologies that have been investigated by the Learning Online Future Technologies (LOFT) program (a program coordinated by the author) at the University of Wollongong are DVD and video/audio streaming. These technologies have been evaluated with regard to their potential for use in learning events.
These evaluations have been reported (Caladine 2001, Caladine 2002a) and the reports included the use of the Learning Activities Model (LAM) to specify the use of these learning technologies is shown Table A1.1 and Table A1.2.

As illustrated by Table A1.1 the Learning Activities Model (LAM) was used to indicate that video/audio streaming was recommended for the category of Provision of Materials. As illustrated by Table A1.2 the LAM was used to compare learning events in which broadband, narrowband and narrowband enhanced through the use of DVD/web hybrid are used for activities in the categories of the LAM.

<table>
<thead>
<tr>
<th>Learning Activities Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PM</strong> - Provision of Materials</td>
</tr>
<tr>
<td><strong>IM</strong> - Interaction with Material</td>
</tr>
<tr>
<td><strong>IF</strong> - Interaction with Facilitator</td>
</tr>
<tr>
<td><strong>IL</strong> - Interaction between Learners</td>
</tr>
<tr>
<td><strong>IA</strong> - Intra-Action</td>
</tr>
</tbody>
</table>

**Table A1.1. Learning Activities Model Analysis of a Learning Event Containing Streamed Files. (Caladine 2002a)**

<table>
<thead>
<tr>
<th>LAM Categories</th>
<th>Narrowband Internet (Web pages)</th>
<th>Narrowband Internet plus (DVD/Web pages)</th>
<th>Broadband Internet (Streaming/Web pages)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of Material</td>
<td>text</td>
<td>text</td>
<td>text</td>
</tr>
<tr>
<td></td>
<td>stills</td>
<td>stills</td>
<td>stills</td>
</tr>
<tr>
<td></td>
<td>limited low quality video</td>
<td>high quality full screen from dvd</td>
<td>video streamed from server (high quality)</td>
</tr>
<tr>
<td>Interaction with Material</td>
<td>text</td>
<td>text</td>
<td>text</td>
</tr>
<tr>
<td></td>
<td>stills</td>
<td>stills</td>
<td>stills</td>
</tr>
<tr>
<td></td>
<td>low quality video</td>
<td>high quality video</td>
<td>high quality video</td>
</tr>
<tr>
<td>Interaction with Facilitator</td>
<td>email</td>
<td>email</td>
<td>email</td>
</tr>
<tr>
<td></td>
<td>Chat</td>
<td>Chat</td>
<td>Chat</td>
</tr>
<tr>
<td></td>
<td>Online Discussion</td>
<td>Online Discussion</td>
<td>Online Discussion</td>
</tr>
<tr>
<td>Interaction between Learners</td>
<td>email</td>
<td>email</td>
<td>email</td>
</tr>
<tr>
<td></td>
<td>Chat</td>
<td>Chat</td>
<td>Chat</td>
</tr>
<tr>
<td></td>
<td>Online Discussion</td>
<td>Online Discussion</td>
<td>Online Discussion</td>
</tr>
<tr>
<td>Intra-Action</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table A1.2. A Comparison of Narrowband, Enhanced Narrowband and Broadband using the Learning Activities Model (Caladine 2001).*

The Learning Activities Model and the Learning Technologies Model have been used to present a framework within which an organisation can change its approach to Human Resource Development. The models were used to provide an understanding of the use of learning technologies and an analysis of current learning activities when they were presented to Energy Distribution Training Services (EDTS), the training provider for the Australian Gas Light organisation as a framework for the exploration of eLearning as a method of increasing the efficiency of training. This was a consultancy undertaken by the author and the handout material is reproduced in Figure A1.2.

**eLearning Terms**

<table>
<thead>
<tr>
<th>Education</th>
<th>Training and Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>teachers</td>
<td>facilitators</td>
</tr>
<tr>
<td>students</td>
<td>learners</td>
</tr>
<tr>
<td>learning</td>
<td>learning</td>
</tr>
</tbody>
</table>

**A description of eLearning**

- An approach to training in which the emphasis is off the “stand and deliver” style
- May be, or have a component that is, technology-based
- May have some flexibility of when and where learners learn

**Learning Activities Model**

Based on the notion that the process of learning can be described as provided materials and interactions.

"Intra-action" describes those things that learners do that do not fit into the other categories. For example, reflection, refinement of opinion, etc.

**Learning Technologies Model**

<table>
<thead>
<tr>
<th>Representational</th>
<th>Dialogic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Print</td>
<td>Text</td>
</tr>
<tr>
<td>2 Audio</td>
<td>Voice</td>
</tr>
<tr>
<td>3 Video</td>
<td>Voice plus image</td>
</tr>
</tbody>
</table>

*Figure A1.2 Reproduction of Handout Material for Energy Distribution Training Services.*

A1.3. Application of the Technology Selection Method.

The models and methods have also been used in the design of higher education subjects. Three examples are presented. They are subjects that were offered by the University of Wollongong in 1999 and 2000 and are: Introduction to Marketing (MARK101), World Wide Networking (IACT303) and Social Programme Evaluation (SOC904). They have been selected for a number of reasons, not the least of which, is that they were subjects that the author helped design or redesign using the Technology Selection Method.

A1.3.1. Example I: Introduction to Marketing.

Introduction to Marketing (MARK101) is an undergraduate, first year subject for students undertaking a degree in marketing, business administration or commerce. It has been taught on campus for many years in a traditional, face-to-face format consisting of lectures and tutorials. In the past, the on-campus student cohort has numbered between 400 and 700. The subject description on the University’s web site states:

“The subject will include the following: concepts and tools for analysing marketing strategies; evaluating the marketplace for opportunities; analysing the marketing environment; researching and selecting target markets; determining the consumer's needs; evaluating the marketing mix in terms of price, product, place and

promotion. Aspects of international marketing, services marketing and social responsibility will also be taught.”


The subject is one of the core subjects for the Bachelor of Business Studies and was offered in 2000 to students at the satellite campuses of the University of Wollongong known as the South Coast Education Network (SCEN). As the South Coast Education Network campuses were some distance from the main Wollongong campus and as some degree of flexibility of where and when learning took place was required, learning technologies were included. The traditionally presented subject predetermined the content for the flexible version and closely followed the prescribed text (Kotler et al, Marketing 1998 Prentice-Hall). The traditional lectures were used to provide further explanation of difficult or lightly treated topics and to provide Australian examples. For the SCEN version of the subject learning technologies were used to emulate the purpose served by lectures. The steps for the selection of learning technologies, as described in Chapter Seven are shown in Table A1.3.

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Use the categories of the LAM to describe the event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2</td>
<td>List all technologies appropriate for the Mechanics of the Subject within each category of the LAM</td>
</tr>
<tr>
<td>Step 3</td>
<td>Refine list of technologies based on Learner and Facilitator Implications, Costs and other criteria</td>
</tr>
<tr>
<td>Step 4</td>
<td>Compare advantages and disadvantages where possible</td>
</tr>
</tbody>
</table>

Table A1.3. The Steps in the Technology Selection Method (TSM).

A picture of the traditionally taught, on-campus subject was created and is shown in Table A1.4.

<table>
<thead>
<tr>
<th>LAM Category</th>
<th>On-campus</th>
<th>SCEN</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction with the Teacher</td>
<td>Face-to-face in lectures. Face to face in seminars. Face to face consultation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction between Students</td>
<td>Face-to-face group work leading to presentation of seminar paper. Face-to-face discussion in seminars. Informal on-campus or off-campus.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intra-action</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table A1.4. MARK101. Step 1 in the Technology Selection Method.*

In the second step of the Technology Selection Method, a short-list was constructed from the list of available technologies (Table 6.14a and Table 6.14b) based on the group of criteria: Mechanics of the Subject. When these were considered, it was felt that although visual media would enhance the subject as it was and will be taught on-campus, it could be effectively taught without them. At this stage they were ruled out. The short-listed Learning technologies are shown in Table A1.5.

In the Provision of Material and Interaction with Material categories of the Learning Activities Model, print, audio and World Wide Web, learning technologies were short-listed as each of these met the demands of the Mechanics of the Subject. As the SCEN subject would use the same textbook as the on-campus subject, print was a foregone conclusion. However, it was thought that other printed materials might be included which contained the same information as the printed material handed out in lectures.

<table>
<thead>
<tr>
<th>LAM Category</th>
<th>On-campus</th>
<th>SCEN</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction with the Teacher</td>
<td>Face-to-face in lectures. Face to face in seminars. Face to face consultation.</td>
<td>email. face to face. phone. fax. videoconference. listserver.</td>
<td></td>
</tr>
<tr>
<td>Interaction between Students</td>
<td>Face-to-face group work leading to presentation of seminar paper. Face-to-face discussion in seminars. Informal on-campus or off-campus.</td>
<td>email. face to face. videoconference. listserver.</td>
<td></td>
</tr>
<tr>
<td>Intra-action</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table A1.5. MARK101. Step 2 in the Technology Selection Method.

The third step in the Technology Selection Method is the refining of the short-list of learning technologies in the light of the criteria: Learner and
Facilitator Implications, and Costs. As the profile of learners indicated that prospective they might not have access to networked computers the World Wide Web was ruled out as a learning technology for the Provision of Materials as were email and listserver for the Interaction categories. As it seemed a safe assumption that most, if not all learners would have access to audio CD players or audio tape players, it was decided to produce audio programs to accompany the text for the categories of Provision of Material and Interaction with Material. It was also decided that the package of audio materials and the text could be enhanced by the inclusion of a printed copy of the audio script. This printed version of the script contained a topic index that allowed learners to easily locate any topic in the textbook, on the audio program and in the script. The removal of Internet communications from the interaction categories caused some concern about how learners would interact with the facilitator and other learners. This concern was alleviated by the decision to hold occasional regional tutorials at the three study centres in the SCEN. Ready access to the facilitator could also be had through telephone and fax. Videoconference was ruled out as a learning technology for interaction as it would reduce the flexibility of time and place of learning as they would need to meet at a videoconference facility at a set time.

During the process of refining the short-list of Learning technologies it was thought that the Internet might be used in subsequent offerings of the subject if the revised profile of learners indicated that they had access to networked computers. It was also thought that videoconference might be
reconsidered if learners indicated their willingness to attend the videoconference facilities at a given time.

There were few if any staff implications that could not be addressed and, as the teacher-designer had experience in radio and audio recording, the production of audio programs fitted within the budget allocated for the SCEN subject. The final mix of techniques and learning technologies is shown in Table A1.6.

<table>
<thead>
<tr>
<th>LAM Category</th>
<th>On-campus</th>
<th>SCEN</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction with Material</td>
<td>Textbook. Library books. Lecture notes and handouts.</td>
<td>print. audio tape/CD</td>
<td></td>
</tr>
<tr>
<td>Interaction with the Teacher</td>
<td>Face-to-face in lectures. Face to face in seminars. Face to face consultation.</td>
<td>face-to-face. phone. fax.</td>
<td></td>
</tr>
<tr>
<td>Interaction between Students</td>
<td>Face-to-face group work leading to presentation of seminar paper. Face-to-face discussion in seminars. Informal on-campus or off-campus.</td>
<td>face-to-face. phone.</td>
<td></td>
</tr>
<tr>
<td>Intra-action</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table A1.6. MARK101. Step 3 in the Technology Selection Method.

In the fourth step the advantages and disadvantages were evaluated. As the subject was to be taught in two different modes (that is, traditionally to
on-campus students and flexibly to SCEN students) a comparison of advantages and disadvantages between both modes was necessary to ensure some level of equity of educational experience between the two groups of learners. In the categories of Provision of Material and Interaction with Material, it was felt that the lack of a human face in the SCEN subject was offset by the flexibility it offered in the time and place of learning. Another concern was in the category of Interaction between Students. While on-campus students have plenty of opportunities to interact with each other, SCEN students would not have the same opportunities. For this reason it was decided to establish networks of SCEN students at the first regional tutorial. It was anticipated that clusters of students in the same locales could be helped to form networks. The advantages and disadvantages are shown in Table A1.7.

When the technology selection process was complete scripts were prepared, the audio recordings made and the package of the script and the audio CDs designed and produced. As the same subject was taught on-campus, the assessment tools used were the same ones as those for on-campus students, namely assignments and examinations.

<table>
<thead>
<tr>
<th>LAM Category</th>
<th>On-campus</th>
<th>SCEN</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction with the Teacher</td>
<td>Face-to-face in lectures. Face to face in seminars. Face to face consultation.</td>
<td>face-to-face. phone. fax.</td>
<td>Restricted access to teacher. Flexibility of time and place.</td>
</tr>
<tr>
<td>Interaction between Students</td>
<td>Face-to-face group work leading to presentation of seminar paper. Face-to-face discussion in seminars. Informal on-campus or off-campus.</td>
<td>face-to-face. phone.</td>
<td>Student networks difficult. Flexibility of time and place.</td>
</tr>
</tbody>
</table>

Table A1.7. MARK101. Step 4 in the Technology Selection Method.

In the case of MARK101, the audio material was tested before all the recording was completed. A sample of students, who had previously studied the on-campus version of the subject, was selected to test the audio materials. They were instructed to emulate the study format that had been designed for South Coast Education Network (SCEN) students where the textbook, the audio programs and the audio script were used together. The results of focus group were positive to the extent that the teacher, designer, department head and the author agreed to pursue this mode of teaching. A summary of the points made by the focus group follows. The members of the focus group:

- were unanimous in their approval of this approach to learning
- believed that the face-to-face/on-campus experience was ‘better’
- believed that this mode of learning was probably the best for the intended audience.
- considered the audio programs to be more valuable than lectures as students could replay sections when required
- considered that the audio programs would be very helpful to on-campus students
- commended the size of the ‘chunks’ of information on the tape
- commended the quality of the actor, the recording and the production values
- considered the tapes to be ‘far superior’ to those used for a recent subject in another faculty
- suggested that more ‘real world’ examples, like those used in the sample program, would enhance the learning experience
- suggested that some extra visual material might help the learning process

The subject, Introduction to Marketing (MARK 101) was offered to students in the South Coast Education Network (SCEN) in 2000 and 2001. While to method was successful, a change of textbook in 2002, imposed by the newly appointed teacher required a redesign of the subject.

World Wide Networking, IACT303, is an undergraduate subject normally taken by learners in the third year of degrees in Computer Science or Information and Communication Technologies. The subject investigates the following issues within the context of World Wide Networking.

- Background: historical perspective
- Web Page Design
- Web Technologies
- Telecommunications Networks and the Web
- Virtual Communities
- Public Sector – Government Policy
- Current Legal Issues and the Web
- The Web and Business
- Security and Financial Payments
- Videoconference
- Publication and the Web
- The Web and Education

The subject has been taught on-campus for several of years using lectures, tutorials and laboratories. Specialist guest lecturers deliver the majority of the lectures. The subject was assessed through group projects and an examination. It was decided to introduce some flexibility to the lecture component of the subject as:

- it was believed appropriate that a subject that investigates the technology would be enhanced by use of the technology

- Flexible Learning could provide opportunities to change the passive role of learners in lectures to an active one
- it might be more efficient

Flexible Learning was also planned for part of the tutorial discussion through the use of Online Discussion. The decision to maintain the traditional, face-to-face tutorials and laboratory classes was made in order to ease students into Flexible Learning. If the flexible elements proved successful other elements might be converted to Flexible Learning in future years. The profile of learners for the subject was based on the experience of previous years. It was anticipated that most learners would have come straight to university from school and that they all would have reasonable computer skills and access to networked computers at home, work or through the departmental computer lab. The objectives for the Flexible Learning subject were to be the same as those for the traditionally taught subject are:

“A student who successfully completes this subject should be able to:

1. identify the technical, social and legal problems related to the developments in world wide networking;
2. debate legal and social issues confronting the global networking community;
3. critically analyse current standards and policies in relation to world wide networking;
4. demonstrate a capacity to work as a team member;
5. discuss the key technical and security related issues confronting network managers; and

6. evaluate use of global networks as an educational medium."

(University of Wollongong 2000, IACT303 web page http://www.itacs.uow.edu.au/subjects/IACT303)

<table>
<thead>
<tr>
<th>LAM Category</th>
<th>Traditional</th>
<th>Flexible</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction with</td>
<td>Face-to-face in lectures. Face-to-face in tutorials and labs. Face to face consultation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>the Teacher</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction between</td>
<td>Face-to-face group work leading to completion of group project. Face-to-face discussion in tutorials and labs. Informal on-campus or off-campus.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intra-action</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table A1.8. IACT 303. Step 1 in the Technology Selection Method.

The first step in the Technology Selection method is the creation of a description of the traditionally taught subject based on the Learning Activities Model as shown in Table A1.8. The content of the subject was prescribed and as specialist guests delivered the lectures in the subject they were responsible for most of the content. The subject matter was
varied and very recent so textbook could not be prescribed. Rather a collection of photocopied articles, or ‘book of readings’ was provided to students at cost.

In the second step of the Technology Selection Method a short-list was constructed from the list of available learning technologies (Table 6.14a and Table 6.14b) based on the group of criteria: Mechanics of the Subject. When these were considered it was felt that the World Wide Web was an obvious choice for the Provision of Material and Interaction with Materials, as all but one of the issues covered in the subject directly concerned the web or had significant references on the web. As videoconference was the issue that did not directly involve the web, it was decided to bring the class together to experience this technology. The learning technologies short-listed for the categories of the Learning Activities Model: Interaction with the Teacher, and Interaction between Students were listserver and Online Discussion. Of course face-to-face interaction in these categories would occur as well during tutorials, laboratory classes and in consultation. Step two of the Technology Selection Method is shown in Table A1.9.

<table>
<thead>
<tr>
<th>LAM Category</th>
<th>Traditional</th>
<th>Flexible</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of Material</td>
<td>Lectures.</td>
<td>World Wide Web videoconference</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Overhead projector slides.</td>
<td>book of readings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Handouts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Book of readings.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction with</td>
<td>Library books.</td>
<td>World Wide Web videoconference</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Lecture notes and</td>
<td>book of readings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>handouts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction with the</td>
<td>Face-to-face in lectures.</td>
<td>Online Discussion</td>
<td></td>
</tr>
<tr>
<td>Teacher</td>
<td>Face-to-face in</td>
<td>email</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tutorials and labs.</td>
<td>Face-to-face in tutorials and labs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Face to face consultation.</td>
<td>Face-to-face consultation.</td>
<td></td>
</tr>
<tr>
<td>Interaction between</td>
<td>Face-to-face group work</td>
<td>Online Discussion</td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>leading to completion of</td>
<td>email</td>
<td></td>
</tr>
<tr>
<td></td>
<td>group project.</td>
<td>listservant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Face-to-face discussion</td>
<td>Face-to-face discussion in tutorials and labs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>in tutorials and labs.</td>
<td>Informal on-campus or off-campus.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Informal on-campus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intra-action</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table A1.9. IACT 303. Step 2 in the Technology Selection Method.

In the third step of the Technology Selection Method the short-list of learning technologies was refined in the light of the criteria: Learner and Facilitator Implications, and Costs. In this step it was decided to use the World Wide Web as the central learning technology for the Provision of Material, and Interaction with Material along with the book of readings as one source of reference material. As learners in this subject are expected to have high levels of computer literacy, and as access to networked computers was readily available through the school’s computer lab (many learners also had access to networked computers at home or work) it was felt that the use of the World Wide Web would have minimal implications.
for learners. As the author carried out the design of the flexible subject there were no concerns about the Implications for the Facilitator. For the Interaction between Learners category, the listserv was ruled out as Learners’ email accounts were of limited size and it was considered that the number of messages created by the discussion would cause them to reach capacity quickly. This would mean that further messages would not be available to them. Hence it was decided to use an Online Discussion tool. The cost implications of the World Wide web pages were minimal as the pages were prepared and maintained by the author in return for access to feedback.

<table>
<thead>
<tr>
<th>LAM Category</th>
<th>Traditional</th>
<th>Flexible</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Handouts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Book of readings.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction with the Teacher</td>
<td>Face-to-face in lectures. Face-to-face in tutorials and labs. Face to face consultation.</td>
<td>Online Discussion email Face-to-face in tutorials and labs. Face-to-face consultation.</td>
<td></td>
</tr>
<tr>
<td>Interaction between Students</td>
<td>Face-to-face group work leading to completion of group project. Face-to-face discussion in tutorials and labs. Informal on-campus or off-campus.</td>
<td>Online Discussion Face-to-face discussion in tutorials and labs. Informal on-campus or off-campus.</td>
<td></td>
</tr>
<tr>
<td>Intra-action</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table A1.10. IACT 303. Step 3 in the Technology Selection Method.*

The staff who previously provided the guest lectures supplied the material for the web pages. The Online Discussion software was available at no

cost on one of the university’s servers. The author undertook responsibility for maintenance of the Online Discussion. Step three of the Technology Selection method is shown in Table A1.10.

In the fourth step in the Technology Selection Method advantages and disadvantages are considered. In the categories of Provision of Material, and Interaction with Material it was felt that the reduction in face-to-face contact with the lecturer was offset by the flexibility gained in where and when learning happened. It was also thought that the inclusion of Online Discussion would serve as an introduction to the face-to-face discussion in tutorials. The advantages and disadvantages are displayed in Table A1.11.

The shell for web pages was then prepared and as the material for each ‘lecture’ was received it was added to the web page for the appropriate week. The Online Discussion was set up and the book of readings printed. The assessment tools were the same as those in previous years, namely: a group project, discussion participation, a group tutorial paper and an examination. However, the allocation of marks for participation in the discussion was increased from 10% to 20% to encourage students to take part in the Online Discussion.

<table>
<thead>
<tr>
<th>LAM Category</th>
<th>Traditional</th>
<th>Flexible</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction with the Teacher</td>
<td>Face-to-face in lectures. Face-to-face in tutorials and labs. Face to face consultation.</td>
<td>Online Discussion email Face-to-face in tutorials and labs. Face-to-face consultation.</td>
<td>Less contact with teacher.</td>
</tr>
<tr>
<td>Interaction between Students</td>
<td>Face-to-face group work leading to completion of group project. Face-to-face discussion in tutorials and labs. Informal on-campus or off-campus.</td>
<td>Online Discussion Face-to-face discussion in tutorials and labs. Informal on-campus or off-campus.</td>
<td>Greater student interaction by web forum and in tutorials.</td>
</tr>
</tbody>
</table>

Table A1.11. IACT 303. Step 4 in the Technology Selection Method.

The Online Discussion was organised in the following way. Before midday on Tuesday learners from two designated tutorial groups had to post messages stating what they thought were the two top issues, with their reasons for them, in that week’s topic in approximately 200 words. Before midday on Thursday of the same week learners from the other two groups must respond to the posting, stating their reasons for agreeing or disagreeing or other issues they believe had been overlooked.

The subject was implemented in the second semester in 1999 with a cohort of some 80 students. Feedback was sought from them through a discussion and questionnaire at the end of the subject. The subject

cooridinator was also interviewed to obtain feedback on the redesigned subject. The questionnaire asked students five questions, the first two of which canvassed students’ opinions of the replacement of lectures by the web pages and of the Online Discussion. As completing the questionnaire was voluntary, only 40 students responded. Table A1.12 shows the first three questions and the responses.

<table>
<thead>
<tr>
<th>Question 1.</th>
<th>Yes</th>
<th>No</th>
<th>No answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did the website help you learn?</td>
<td>33 82.5%</td>
<td>4 10%</td>
<td>3 7.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 2.</th>
<th>Web</th>
<th>Lecture</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you prefer lecture or the website?</td>
<td>27 67.5%</td>
<td>4 11%</td>
<td>9 22.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 3.</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did you have adequate access to a computer?</td>
<td>39 97.5%</td>
<td>1 2.5%</td>
</tr>
</tbody>
</table>

Table A1.12. IACT303 Student Questionnaire Responses.

The last two questions were:

- Question 4. What do you think are the strengths and weaknesses of this web site for teaching and learning?
- Question 5. What suggestions do you have for improving the way this subject is taught?

Seven broad strengths and weaknesses of the website were identified in the responses to the questionnaire. They are listed in Table A1.13.

<table>
<thead>
<tr>
<th>Strength or Weakness</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexibility of when and where</td>
<td>16 (40%)</td>
</tr>
<tr>
<td>Don’t have to attend lectures</td>
<td>1 (2.5%)</td>
</tr>
<tr>
<td>Extra information provided by website</td>
<td>14 (35%)</td>
</tr>
<tr>
<td>Online Discussion – as a strength</td>
<td>7 (17.5%)</td>
</tr>
<tr>
<td>Online Discussion – as a weakness</td>
<td>2 (5%)</td>
</tr>
<tr>
<td>Less feedback than lecture</td>
<td>5 (12.5%)</td>
</tr>
</tbody>
</table>

Table A1.13. IACT 303 Responses to Questions 4 and 5.

The interview with the subject coordinator revealed several positive outcomes of the redesigned subject. The greatest change reported by the coordinator was that tutorials were now more productive as they were now characterised by intellectual argument and informed discussion. The coordinator attributed this to a radical change in the proportion of learners who prepared for tutorials. She estimated that 90% – 99% of learners in tutorials had read the materials beforehand compared with an estimated 10% in the old version of the subject. Another change reported by the coordinator was that while learners were just passive listeners in the lectures in the old subject, now they are actively involved and working. She also mentioned that many of the learners who were “quiet” in the face-to-face tutorial took an active part in the Online Discussion. When asked about the efficiency of the redesigned subject, the coordinator indicated that preparation times for the web page materials were just as long if not longer than that for lectures but slight gains were made in not
having to supply the lecture notes to the library. She considered that the next time the subject was offered the preparation time would be of a similar length as the subject deals with extremely current issues and that the links supplied on each week’s web page would have to be checked for integrity and currency. The coordinator also mentioned that tutorial attendance was slightly better than that of previous years and that the assessment results indicated that all learners completed the assigned tasks.

The coordinator also reported that she hoped to use the redesigned subject for learners in overseas locations in the future. Of course she realised that this would bring other challenges to the subject design such as the undertaking of virtual group work by learners.


Social Program Evaluation and Planning, SOC904, was a postgraduate subject offered to learners undertaking a range of postgraduate degrees. The majority of learners was studying in the area of Public Health Administration.

The subject was designed to equip learners with the basic intellectual and practical skills for the evaluation of social programs. As the skills of critical and informed thinking were central to the subject it was characterised by a significant quantity of resources or readings and student discussion. SOC904 was a new subject and some flexibility was thought desirable in the design, as many learners were busy professionals who could not
afford the four hours per week of classes that subjects of this kind had previously required. Most of the learners were of mature age, working full-time in mid- to high-level administrative positions in the public health sector. All but one learner had medium or better levels of computer literacy and access to a networked computer either at work home or both.

“The overall objective of this subject is to equip students with:

- a knowledge of the main theoretical approaches to program evaluation;

- an understanding of the distinction between program evaluation and social science research, and also of the links between the two;

- an appreciation of the importance of the cultural, political and social context in any evaluation project;

- some basic practical skills in the organisation, presentation and communication of evaluation findings; and the methodological basis for developing practical skills in data collection and organisation.

All of this may be summed up as attempting to give students enough theoretical insight and practical design and analysis skills to enable them to undertake basic evaluations of social programs with reasonable confidence.”

(http://cedir.uow.edu.au/subjects/sociology/SOC904/)
The first step in the Technology Selection method is the description of the subject using the categories in the Learning Activities Model as shown in Table A1.14.

<table>
<thead>
<tr>
<th>LAM Category</th>
<th>On-campus</th>
<th>Flexible</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of Material</td>
<td>Selected articles in print. Selected articles in databases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction with Material</td>
<td>Read selected articles in print. Read selected articles in databases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction with the Teacher</td>
<td>Face-to-face in seminars. Face-to-face consultation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction between Students</td>
<td>Face-to-face discussion in seminars. Informal on-campus or off-campus.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table A1.14. SOC 904. Step 1 in the Technology Selection Method.*

In the second step of the Technology Selection Method a short-list of available learning technologies (Table 6.14a and Table 6.14b) was developed based on the group of criteria: Mechanics of the Subject. When these were considered it was decided that as full text versions of many of the prescribed articles were contained in databases that some on-line component of the subject would be necessary. As some flexibility was sought to reduce the amount of time learners spent on campus and as the subject was based on discussion some form of Online Discussion was thought likely. The short-listed learning technologies for the provision of materials included print and World Wide Web. The short-listed learning

technologies for Interaction with the Teacher and Interaction between Students included email, Internet Chat, Online Discussion and listserver and it was decided to keep some face-to-face discussion in both categories. The short-listed learning technologies and techniques are shown in Table A1.15.

<table>
<thead>
<tr>
<th>LAM Category</th>
<th>On-campus</th>
<th>Flexible</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction with Material</td>
<td>Read selected articles in print. Read selected articles in databases</td>
<td>Read print materials. Interact with World Wide web.</td>
<td></td>
</tr>
<tr>
<td>Interaction with the Teacher</td>
<td>Face to face in seminars. Face to face consultation.</td>
<td>email. listserver. Internet Chat. Online Discussion. Face-to-face</td>
<td></td>
</tr>
<tr>
<td>Interaction between Students</td>
<td>Face to face discussion in seminars. Informal on-campus or off-campus.</td>
<td>email. listserver. Internet Chat. Online Discussion. Face-to-face</td>
<td></td>
</tr>
<tr>
<td>Intra-action</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table A1.15. SOC 904. Step 2 in the Technology Selection Method.

In the third step of the Technology Selection Method the short-list of learning technologies was refined in the light of the criteria: Learner Implications, Facilitator Implications and Costs. As the profile of learners indicated that most had access to networked computers, and as many of the prescribed and recommended readings were available from databases, it was decided to reduce the amount of printed material for the Provision of Material, and Interaction with Material categories. It was also decided to provide printed material for only those readings not found on
the databases. As the subject had a small budget it was decided a web designer would be hired to create the web pages, thereby reducing the design load of the facilitator and the need for them to acquire these skills. For the category of Interaction between Learners it was decided to use a listserver. It was felt that a listserver was preferable to a Online Discussion as messages from the listserver were sent directly to learners’ email accounts. With the Online Discussion, learners have to log on via a specific link or web address. As mentioned earlier some degree of face-to-face discussion was planned as well. Internet Chat was ruled out as its synchronous nature would reduce the flexibility of time of learning. For the category of Interaction with the Facilitator, Online Discussion and Internet Chat were ruled out for the same reasons as mentioned in the previous category. Interaction with the Facilitator was by personal email, listserver, face-to-face consultation and in tutorial discussions. The revised list of learning technologies and techniques is shown in Table A1.16.

<table>
<thead>
<tr>
<th>MOLTA Category</th>
<th>On-campus</th>
<th>Flexible</th>
<th>+/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction with Material</td>
<td>Read selected articles in print. Read selected articles in databases</td>
<td>Read Print materials. Interact with World Wide web.</td>
<td></td>
</tr>
<tr>
<td>Interaction with the Teacher</td>
<td>Face to face in seminars. Face to face consultation.</td>
<td>Email. listserver. Face to Face in tutorials.</td>
<td></td>
</tr>
<tr>
<td>Interaction between Students</td>
<td>Face to face discussion in seminars. Informal on-campus or off-campus.</td>
<td>Email. listserver. Face to Face in tutorials and consultation.</td>
<td></td>
</tr>
</tbody>
</table>

Intra-action

Table A1.16. SOC 904. Step 3 in the Technology Selection Method.

As SOC904 was a new subject it was not possible to compare the advantages and disadvantages with a traditionally taught subject. However, it was thought that the proposed mix of learning technologies and techniques would allow greater flexibility, of time and place of learning, compared to similar subjects that were taught traditionally. The shell for the web pages was created and as the facilitator created materials for each workshop these were converted to HTML and added to the website. The prescribed readings were located and links to the databases included in the web pages. The web page for each workshop included:

- the objectives of the workshop
- key concepts
- links to readings
- workshop activities and exercises

The listserver discussion was organised in the following way. After reading all the core literature, and with agreement with the facilitator, individual learners then selected one item which they summarised in not more than 500 words and not less than 400. This summary was then posted on the listserver no later than 72 hours before the workshop. By agreement with the facilitator, the other learners wrote 100-word critiques of one of the posted summaries. This, in turn, was posted not less than 24 hours before the workshop. As the subject was designed to encourage the maximum participation, assessment was heavily influenced by the quality of individual learner's contribution to class activities, both electronic and face-to-face. The assessment tasks required of students took the following form:

- listserver postings 30%
- Four 'Key Concept' Quizzes 20%
- General Class Participation 15%
- Major Project: at least 3000 words 35%

The subject was implemented in the first semester in 1999. Learners were encouraged to contact the facilitator at any stage of the subject to report any problems or difficulties. These were then treated as a matter of urgency. Towards the end of the subject, a discussion of the way in which the subject was designed enabled learners to provide feedback. Learners were asked questions about the web pages, the listserver and for suggestions to improve the subject.
Feedback on the web pages and listserv was quite polarised. Learners who were employed fulltime praised the flexibility of time and place the subject offered in comparison to other subjects they were taking. A small minority of learners suggested that they would prefer lectures as they were on-campus anyway and the computing facilities in the laboratory were subject to high demand and frequent breakdowns. One learner from overseas, who had never used a computer before, praised the design of the subject as it gave him a reason to become computer literate. Learners were generally happy with the subject and suggested that it could be improved by assisting networking through a voluntary list of learners’ names and phone numbers on the web pages or distributed by email. The facilitator was very pleased with the new subject although he admitted that preparation time was far greater than that for lectures. He has adopted a revised version of the same format for other subjects.