Informal Learning at Work:
The art of learning by doing

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In contemporary Australian society, educational institutes – schools, TAFE Colleges and universities – are well-recognised as places of formal education. However, there are many people who, upon reflection, would admit that much of what they know and can do, particularly at work, has been acquired, not during formal institutional education but outside of those institutions, while at work, either doing or attempting to do, their work.

This research draws on the works of educational researchers and theorists including Dewey, Vygotsky, Piaget, Ryle, Knowles, Nonaka, Illeris, Choo, Jarvis, Schön, Billett, Hager, Beckett, and others. The research initially reviews theories relating to learning such as behaviourism, cognitivism and constructivism. I then move on to those relating to adult and workplace learning, such as Knowles’ Andragogy, Dewey’s purpose, and Illeris’ three dimensions of learning, before finally reviewing the more holistic or organic theories of human learning put forward by Jarvis, Beckett and Hager, Schön, and others. This framework of theories is then used to provide the base upon which this research is built.

Eight case studies of adults at work, and their encounters with novel situations, are analysed and discussed to formulate an understanding of the processes involved in this type of learning and the value it provides to both the informal learners and the organisations in which they work. Finally, what is learned from both the literature and the eight cases studied, is combined and distilled to provide an understanding of this type of learning, and identify its defining characteristics.
Declaration

This is to certify that

i. this thesis comprises only my original work towards the degree of Doctor of Education,

ii. due acknowledgement has been made in the text to all other material used,

iii. this thesis is less than 100,000 words in length, exclusive of tables, maps, bibliographies and appendices.

Signature: ...............................................................
Acknowledgements

This dissertation represents the culmination of a journey that has taken more than 15 years and began with an Associate Diploma in Training and Development in 1994. It is a journey which has constantly stimulated and challenged my intellect, my interests and my resolve, teaching me not only about ‘Adult Education’ but also about myself. This has been a journey facilitated throughout by the exceptional academic staff of the Melbourne Graduate School of Education and its predecessor, the Faculty of Education, of the University of Melbourne.

My sincere thanks go to my supervisors, Dr David Beckett and Dr Peter Waterhouse, who provided extremely valuable advice, continually stimulated and challenged my thoughts, and, of course, supported and encouraged me throughout the whole process.

My appreciation goes to the subjects of the case studies who agreed to being interviewed. They are all busy people and their contributions have been invaluable.

To my wife Sheryl, who has patiently supported me through this project and the hours I have spent mulling over the research, listening to the interview tapes, writing and re-writing the content, none of this would have been possible without her love, encouragement and support.
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<table>
<thead>
<tr>
<th>Abbreviation</th>
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<tr>
<td>ANTA</td>
<td>Australian National Training Authority. The functions of which were transferred to the Department of Education, Science and Training (DEST) which was renamed the Department of Education, Employment and Workplace Relations (DEEWR) in 2008.</td>
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<tr>
<td>AQF</td>
<td>Australian Qualifications Framework</td>
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<tr>
<td>CBT</td>
<td>Competency Based Training</td>
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<td>CBTA</td>
<td>Competency Based Training and Assessment</td>
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<td>DEET</td>
<td>Department of Employment Education and Training</td>
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<tr>
<td>GSM</td>
<td>Global System for Mobile communications</td>
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<td>ICT</td>
<td>Information and Communications Technology</td>
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<td>LOTO</td>
<td>Lock Out Tag Out</td>
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<tr>
<td>MCEETYA</td>
<td>Ministerial Council on Education, Employment, Training and Youth Affairs</td>
</tr>
<tr>
<td>NCVER</td>
<td>National Centre for Vocational Education Research</td>
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<tr>
<td>OVAL</td>
<td>The Australian Centre for Organisational, Vocational and Adult Learning, a former research centre at the University of Technology, Sydney. It has been subsumed into the University's Centre for Research in Learning &amp; Change.</td>
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<tr>
<td>PC</td>
<td>Personal Computer</td>
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<tr>
<td>PIN</td>
<td>Provisional Improvement Notice</td>
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<tr>
<td>PME</td>
<td>Planned Maintenance Event</td>
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<td>RMIT</td>
<td>Royal Melbourne Institute of Technology</td>
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<tr>
<td>RCC</td>
<td>Recognition of Current Competence</td>
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<tr>
<td>RPL</td>
<td>Recognition of Prior Learning</td>
</tr>
<tr>
<td>RTO</td>
<td>Registered Training Organisation</td>
</tr>
<tr>
<td>UTS</td>
<td>University of Technology Sydney</td>
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<tr>
<td>VE</td>
<td>Vocational Education</td>
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<td>VET</td>
<td>Vocational Education and Training</td>
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## Glossary

<table>
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<th>Term</th>
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<tr>
<td>Behaviourist</td>
<td>Behaviourist theories of learning focus on the observable behaviour with little or no regard to the cognitive functions</td>
</tr>
<tr>
<td>Biography</td>
<td>The sum of an individual’s life long learning experiences at a particular point in time.</td>
</tr>
<tr>
<td>Cognitivist</td>
<td>Cognitivist theories of learning are concerned with the brain functions that involve information processing.</td>
</tr>
<tr>
<td>Constructivist</td>
<td>Constructivist theories of learning are concerned with how humans generate knowledge and meaning from their experiences.</td>
</tr>
<tr>
<td>Epistemology</td>
<td>The branch of philosophy dealing with the theory of knowledge.</td>
</tr>
<tr>
<td>Formal learning</td>
<td>Also formal training, education or training provided in educational institutions, such as schools, universities, colleges, etc. or off the job in a workplace, usually involving direction from a teacher or instructor.</td>
</tr>
<tr>
<td>Higher School Certificate</td>
<td>Year 12 level of secondary education in NSW.</td>
</tr>
<tr>
<td>Informal learning</td>
<td>The acquisition of knowledge and skills through experience, reading, social contact, etc.</td>
</tr>
<tr>
<td>Informal workplace learning</td>
<td>The acquisition of knowledge and skills through experience, reading, social contact, etc. at work.</td>
</tr>
<tr>
<td>Non-formal learning</td>
<td>Organised education and training outside of the formal education system.</td>
</tr>
<tr>
<td>Ontology</td>
<td>The branch of philosophy dealing with the nature of being.</td>
</tr>
<tr>
<td>Phronesis</td>
<td>Aristotle’s practical wisdom.</td>
</tr>
<tr>
<td>Practical judgement</td>
<td>Judgement that results in a practical (often work related) outcome.</td>
</tr>
<tr>
<td>Practice-based learning</td>
<td>The acquisition of knowledge and skills through experience and social contact, etc. at work.</td>
</tr>
<tr>
<td>Statement of Attainment</td>
<td>Certification issued to a student for partial completion of a qualification, including, where relevant, the units of competency achieved under nationally endorsed standards. Achievement recognised by a Statement of Attainment can accumulate towards a qualification within the Australian Qualification Framework.</td>
</tr>
<tr>
<td>Safety Map</td>
<td>Safety Management Achievement Program. A WorkSafe Victoria audit tool that provides the means to undertake an independent audit and review of an organisation's health and safety management system.</td>
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<tr>
<td>Socio-political</td>
<td>The intersection of personality, social structure and politics. In particular, this relationship in the workplace.</td>
</tr>
<tr>
<td>Socio-technical</td>
<td>The intersection of people and technology in the workplace.</td>
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<tr>
<td>Training Package</td>
<td>An integrated set of nationally endorsed standards, guidelines and qualifications for training, assessing and recognising people’s skills.</td>
</tr>
<tr>
<td>WorkSafe Victoria</td>
<td>A statutory body responsible for managing the state of Victoria’s workplace safety system.</td>
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Learning is like food, ingest it and it will enrich the human being: unlike food it is difficult to have too much. It is possible to eat the wrong things and likewise it is possible to learn the wrong things. (Jarvis 2006: 3)
Chapter I

Context and Questions

(Introduction)
1.1 Workplace context

As a Vocational Education and Training (VET) practitioner, I have been involved in the training and assessment of people in workplaces, in one way or another, for more than nineteen years. My initial entry into VET was as an industry-based trainer and for much of the past five years I have been a manager of VET practitioners, systems and processes, in Victorian-based private Registered Training Organisations (RTOs). Recently I moved from a private sector, non-industry based RTO to an industry based RTO, a manufacturer based in Melbourne’s Western suburbs, where I am responsible for the learning and development of more than 300 employees as well as the operation of the RTO, which also operates on our manufacturing sites in Adelaide, Sydney and Brisbane.

My interests in the field of VET are many, but for the purpose of this dissertation my focus is directed to how people develop competence informally, and, in particular, their ability to learn and solve work-related problems, both expected and unexpected, over their life-time. This interest is to some degree, underpinned by the requirement that RTOs offer all trainees Recognition of Prior Learning (RPL) and that all prior learning is to be recognised, regardless of where or how it was learned (DEST 2010).

The Australian VET sector is principally involved in the provision of Competency-Based Training and Assessment (CBTA). In 1998, the Australian National Training Authority (ANTA) described competency as the “specification of knowledge and skill and the application of that knowledge and skill to the standard of performance expected in the workplace” (ANTA 1998 in Misko 1999). More generally, Hager et al. (1994: 5) defined ‘competency’ as comprising the specification of knowledge and
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skill and the application of that knowledge and skill to the standard of performance required in employment. This concept of ‘competence’ includes all aspects of work performance, and includes: performance at an acceptable level of technical skill; organising one’s tasks; responding and reacting appropriately when things go wrong; fulfilling a role in the scheme of things at work; and the transfer of skills and knowledge to new situations. Taking a slightly different perspective, Beckett and Hager (2002) summarise competence as being relational, stating that:

It links together at least three disparate sorts of things. Competence is essentially a relation between *abilities or capabilities* of people and the satisfactory completion of *appropriate tasks* in particular *settings*. (Beckett & Hager 2002: p57, italics in original)

These three definitions, and in particular the latter, describe competency holistically and bring together a range of factors, that, when viewed individually, are unable to produce a competent performance.

But performance, at work, has a wider context. After the end of World War II, a new economic age dawned, bringing with it a new economy, the “Knowledge Economy” (Drucker, 1993). As the international economic landscape began to change, a new management paradigm and, new asset, were brought on to the balance sheets of many corporations, the paradigm of knowledge-centred management and Intellectual Capital (Wiig, 1997). With these changes, knowledge work, the knowledge worker, and knowledge itself, gained prominence, creating new problems such as the efficient management of knowledge and a new way of doing work, referred to by some as symbolic analysis. With knowledge work rapidly overtaking
that of traditional skilled work, and with the boundaries between skilled and knowledge work blurring, the question that arose for many VET practitioners, including myself, was: will formal or “front end” education and training be able to provide people, and the organisations in which they work, with the ability to keep up with the changes taking place in today’s rapidly changing global market place?

There are already indicators that the answer is no. Cornford (2000), reports that during the period 1994-97, Australia’s relative international competitiveness actually declined, suggesting that current approaches to education and training may have failed to live up to expectations. Schön (1987: 8) echoes these concerns as a crisis of confidence in professional knowledge and education, and he states: “If professions are blamed for ineffectiveness and impropriety, their schools are blamed for failing to teach the rudiments of effective and ethical practice”.

During the past three decades, the fundamental requirements of industrial work, bodily exertion, manual dexterity and endurance, have been increasingly displaced by the requirements for rapid perception, attentiveness and the ability to analyse problems and make decisions (Hirschhorn, 1984; Zuboff, 1988, in Casey, 1999). In 1989, in an effort to improve Australia’s ability to compete in a global marketplace – by developing a more skilful and adaptive workforce – Competency-Based Training and Assessment was adopted as the principal educational model for the Vocational Education and Training sector.

In its simplest and, arguably, most popular form, CBTA is a modular, behaviourist, instrumental and outcomes-based approach to the teaching and assessment of
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competence. This approach to VET in Australia served to highlight a key cause for concern amongst some educational commentators: the dichotomy between general and vocational education. A dichotomy that has its origins in the thoughts and teachings of Plato and Aristotle, and which was later enshrined by Descartes’ dualism. It is this schism of knowledge, captured in the Vocational sector’s “knowing how” or procedural knowledge, and the Higher Education sector’s “knowing that” or propositional knowledge, that has served to subordinate procedural knowledge, to that of propositional knowledge.

This subordination of procedural knowledge is further entrenched through common CBTA practices and the instrumental specification of this knowledge, which is largely premised on rule-following rather than problem-solving. Though Training Packages, and the units of competency that they contain, require the acquisition of problem-solving skills and in particular, the ability to transfer skills from one situation to another, the instrumental rule-following that they assume, both complicates and problematises this requirement.
1.2 The theoretical context

While CBTA plays a significant, if problematic, part in workplace learning in the VET sector, for many Australian enterprises, it is but one of many pedagogies to be found in use. Workplace learning often spans the complete spectrum from highly structured and formal off-the-job education, to unstructured and informal on-the-job training, and includes learning that can be planned or unplanned, informal, non-formal, structured, unstructured, passive and active.

Knowledge and learning, and their role in the development and exercise of competence, are of significance to this study. Issues such as formal or structured learning and informal or unstructured learning, including the notion of organic workplace learning, will be investigated. Propositional knowledge (knowing that), procedural knowledge (knowing how) and *phronesis* (practical judgement/wisdom), as well as conceptions of tacit and explicit knowledge, as far as they relate to the workplace, will also be investigated.

In the workplace, at the heart of this, is informal learning: learning that is often unplanned, that occurs on-the-job, and just-in-time, as individuals or groups act towards the achievement of an objective. And while the structuring and outcomes of that learning are important, to both the learner and her or his organisation, what is of particular interest to me, in this study, is the process of learning, or more specifically, how learners engage with their workplace problems and learn new ways of working. Also of interest is the role of ‘practical judgement’ (*phronesis*) and how it is used in on-the-job learning processes. Therefore, my objective is to build an understanding of informal workplace learning and the role that practical judgement plays in it.
1.3 The research questions

While CBTA is the dominant workplace pedagogy in Australia (at least officially), a significant amount of informal learning, that is unplanned, incidental, and perhaps even accidental, also occurs outside of this “dominant” paradigm. It is this informal learning, generated – not by a consciously devised plan or curriculum – but, by a need for either an individual or group to purposely solve a pressing problem, a problem that must be solved if the job is to be done, that will form the basis of this study. Therefore, the questions that this study seeks to answer are:

1. To what extent is informal workplace learning enabling people at work to acquire new, relevant and worthwhile, that is, value-adding, workplace knowledge and skills?

2. To what extent is judgement a key enabler in the development of this new workplace knowledge?

3. What are the key characteristics of this informal learning?

In pursuing this research I seek to understand something about the nature and value of informal workplace learning to individuals and the organisations in which they work, and the role that judgement plays in the discovery of knowledge embedded in the solving of workplace problems.
1.4 About the methodology

The methodology for this research, explained in detail in Chapter III, is based on a series of interviews with professionals who recount their experiences of informal workplace learning. Told conversationally as ‘stories’, rather than the formal and structured question-and-answer interview format, the cases provide rich, thick narratives of each of the subject’s experiences with informal learning at work. From six subjects, eight case studies have been produced that provide an incremental examination of informal learning at work. The cases presented begin with a simple problem, complicated by pre-conceptions of how things should be done. They then develop as we examine how their mental models/schemata or as Jarvis describes them, biographies, and other human factors such as networks and organisational structures, both formal and informal, including communities of practice, provide understandings of how people learn by doing, and how these factors can either facilitate or interfere with this type of learning.
1.5 The significance of this study

The purpose of this study is not to develop a single, universal theory of human learning. Human learning is far too complex to be understood in a single study, and perhaps, far too complex ever to be explained in a single theory. My purpose here, and therefore the significance of this study, is to highlight the richness embodied in learning by doing (as many others have done before me), and to add to the richness of our understanding of the way in which humans create knowledge as they encounter and solve problems in their day-to-day work life. More importantly, though, is the emphasis on learning, rather than on teaching. The cases presented in this study provide us with descriptions of independent individuals who, for the most part, eschew either deliberately or incidentally, most, if not all, social contributions to their learning endeavours as they draw primarily, on their own knowledge (their biographies), and the information they are able to draw from their work environments, to solve significant workplace problems. The nature of the learning, described herein, demonstrates and adds to the contributions of Dewey, Illeris, Jarvis, Beckett, Hager and others on holistic and action-oriented learning, or learning by doing, and the work of Schön and his contributions on reflection-in-action, knowing-in-action and professional artistry.

By increasing our understanding of how humans learn, educators in all sectors, and in particular those in the VET sector, can better create learning experiences for their students. Rather than advocate a teaching and learning approach that is either teacher-centred or learner-centred, I advocate a learning-centred approach that privileges neither pedagogy, andragogy nor heutagogy. In this approach, the learning experience, that is, the processes of learning, in particular, processes that
involve Dewey’s *purpose*, are put to the fore, as it is the quality of the learning experience, rather than the quality of the teaching, that will be the greater determining factor of the quality of what is learned. As the majority of the cases will demonstrate, humans are quite capable of learning without the aid of teachers, academic texts or other educational artefacts.
1.6 Structure

This dissertation is arranged in five chapters. Chapter I, Context and Questions, sets out to describe the Vocational Education and Training environment and the research context in which this study is situated. The three research questions were also provided along with a brief description of the methodology used, the significance of this study and the structure of this dissertation.

Chapter II, Learning and Knowing, presented in six parts, is a literature review that begins (in Part 1) with a brief description of learning theory from the fields of psychology, education, educational philosophy and sociology. This is intended to give the reader an understanding of my thinking on learning and also a brief overview of how educational thought and practice over the past one hundred years or so has both evolved and, to some extent, revisited itself in the resurgent interest in educational philosophers such as Dewey and his thinking on learning by doing. Part 2 of this chapter, Knowledge and Knowing, has been included because this is a study of how people acquire knowledge, so it is only sensible to include a section that outlines how knowledge is understood by many contemporary educators. Part 3 provides a description of the difference between formal and informal learning as well as an overview of self-directed learning and learning at work, all important contributions to this study. Part 4 discusses judgement and decision-making and their role in the learning process, while Part 5 briefly explores the work of Schön, another key contributor, and his ideas on knowing-in-action, reflection-in-action and professional artistry. Part 6 of Chapter II provides a critical conclusion to the key findings from the literature.
Chapter III, Research Design, explains the methodology used in this study. A naturalistic, qualitative approach, based on eight case studies, is used. Chapter IV, The Individual and Practice-Based Learning, combines what, in many cases, would normally be two chapters, the findings and their associated discussions. Combining the two chapters brings the two most important parts of this study together. As each case is described and explored, what is learned from each is then immediately discussed, keeping the discussions in broader context and yet concurrent with the data on which they are based.

Chapter V, Purposeful action: An epistemology of practice, extracts the key research learnings from Chapter IV and identifies the characteristics of informal workplace learning and the professional artistry that defines it. In this, the final chapter, I name and describe the critical points in the learning process, beginning with an encounter with the unknown and the learners’ desire to make sense of this new situation and their use of purpose to focus their learning effort. They then go about the process of naming and framing the problem, that is, defining their situation in terms that they, the learners, can understand, in such a way that a problem-solving process can be commenced using only the sum of what is known at the time (their biographies) and what they can learn from their environment.

I also answer the research questions by drawing upon the discussion and findings in Chapter IV, and conclude with some suggestions/recommendations for further research in this area.
Chapter II
Learning and Knowing

(Literature Review)
2.1 Introduction

Most educational research is on children and most views of learning have been developed in the context of children learning within a formal educational system. Inevitably such views have been tied into child development and compulsory schooling. However, when one moves away from models of child development, and examines the models which have been produced from disciplines looking at settings beyond compulsory schooling, a very different view of learning emerges (Tusting & Barton 2003: 2).

A significant problem for people in VET, who are working in industry, is that everyone ‘knows’ what learning is about. We have all been to school, and these educational experiences have shaped our perceptions of what learning at work will involve. Simply put, the common perception is that learning (or training) requires time away from work so that learners can sit in a classroom and be told by a teacher (trainer) what they need to know. This is unattractive to many managers because their people are taken away from ‘productive’ work to sit in a classroom, which they clearly regard as unproductive, and, in many cases, rightly so. They also see training as a cost, and rarely is it considered an investment, regardless of its purpose or expected outcome. But what I have just been discussing is not so much about perceptions of learning, but of teaching, and in particular what these perceptions tell us about our experiences with school or classroom-based learning. On the other hand, informal workplace learning often goes unrecognised and unacknowledged. It is seen simply as part of our work.
Learning is concerned with the acquisition of knowledge, both propositional and procedural. However, in the context of the workplace, our ability to successfully apply our knowledge, (regardless of where, when, and how it is acquired) and achieve a particular and productive outcome, would seem to be the primary concern. Knowledge and how we come to know has been explored, discussed and disputed by philosophers and scholars since Plato, while scholars from the relatively new fields of psychology, sociology and education have only been studying the phenomenon for around 100 years. This ‘scientific’ study of learning commenced with behaviourism in the early 20th Century, then cognitivism or information processing, in the mid-20th Century, and, more recently, constructivism. Rather than fragment our understanding of knowledge and our acquisition and application of it, these ‘isms’ have contributed significantly to our understanding not only of learning, but also of our assessment of it.

There is a distinct difference between learning and teaching. Rogers (1969 cited in Hase & Kenyon 2000) goes as far to suggest that “[w]e cannot teach a person directly: we can only facilitate learning.” This distinction is even greater when we look at the differences between informal and formal learning. Informal learning can involve teaching in some form or other, for example, an informal teacher may, in fact, be a colleague or mentor with an unofficial and perhaps unrecognised teaching or training role. In this sense ‘informal’ relates to both the purpose of the learning and the nature of the teaching, i.e. learning is not being pursued for the purpose of some formal recognition such as a qualification, and the teaching is often undertaken by someone whose role or function, even at a secondary level, does not ‘formally’ involve teaching or training. Self-directed learning, on the other hand, is a form of
informal learning that often does not involve teaching, either formally or informally, but simply involves the learner, and his or her environment.

Pedagogy has been with us since the ancient Greeks, Aristotle in particular, and has traditionally explained the teacher-student relationship by placing the teacher at the forefront. In a strictly traditional pedagogical approach, the teacher takes all of the responsibility for the learning that either does or does not take place. It explains to us what the teacher needs to do to maximise the transfer of knowledge, from the teacher to the student. Andragogy, introduced to the USA in a 1968 article by Malcolm Knowles (Merriam et al. 2007), is based on a term originally attributed to the German educator Alexander Kapp (Knowles et al. p59). Andragogy shifts the focus from the child to the adult learner but still with an emphasis on teaching. Heutagogy too (Hase and Kenyon 2000, Hase 2003) is centred on the adult learner, but in this context, a learner that takes responsibility for his or her own learning. Heutagogy therefore, presents itself as a learner-centred theory of learning, providing a particular emphasis on the self-directedness of the adult learner. The self-directedness of the adult learner is also a key feature in discussions on lifelong learning, informal learning and workplace learning.

In this chapter we first explore knowledge and knowing and what I, and others, have come to understand these two concepts to mean. As learning involves the acquisition of knowledge, an understanding of what knowledge means to me will help the reader to put this study into an appropriate context. Secondly, judgement and decision-making are briefly examined and defined, and so too, is informal learning. These concepts are important contributors to this study and both need to be
explained so the reader is able to put the two into an appropriate context. Finally, a number of learning theories, and models, from psychology, sociology and education are reviewed to provide the reader with some small appreciation of the depth and breadth of our current understandings of learning and how these contribute to my own work and this dissertation.
2.2 Knowledge and Knowing

Despite the fundamental differences between rationalism and empiricism, Western philosophers have generally agreed that knowledge is “justified true belief,” a concept that was first introduced by Plato (Nonaka & Takeuchi, 1995: 21).

But what is a “justified true belief” and what relevance does this definition have for workplace knowledge? To attempt to provide an insight into these questions I will briefly explore the differences between Western and Eastern (specifically Japanese) perspectives on knowledge and knowledge creation in workplaces. The modern Western view of workplace knowledge has largely been shaped by people like Frederic Winslow Taylor and the concept of scientific management which he helped to develop early in the twentieth century (Nonaka & Takeuchi, 1995: 8, 35-6). It is this scientific view of management that brought to prominence the use of information in workplace or organisational decision-making. This is, by and large, limited to that which can be easily recorded and documented (digitised), assessed, measured or expressed, that is, it is explicit. On the other hand while Japanese workplaces are effective users of explicit knowledge, they also acknowledge, and place a great emphasis on, tacit knowledge, knowledge that by its very nature is difficult to express, and consequently to record or document (Nonaka & Takeuchi, 1995: 8).

Knowledge is both broad and complex and consists of types and states. It is generally agreed that there are two broad types of knowledge, propositional
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(knowing that), and procedural (knowing how) and that while propositional knowledge is regarded as being largely explicit, procedural knowledge, on the other hand, is regarded as being largely tacit (Ryle, 1949: 27-32). Propositional, sometimes called declarative or conceptual knowledge (Billett, 2001: 50), is concerned with facts, propositions and concepts etc., whilst procedural knowledge relates to tasks and skills. From this dual dimension of type, we move to knowledge’s two states, the tacit (Polanyi 1966) and the explicit (Cohen & Manion 1994). Explicit knowledge is knowledge that is tangible and capable of easy transmission, whereas tacit knowledge is seen as more a product of the mind, essentially personal and consequently difficult, if not impossible, to transmit (and digitise) at all.

2.2.1 Two types of knowledge

In the context of CBTA, propositional knowledge might be generally regarded as underpinning or essential knowledge. Propositional knowledge also ranges across various levels of complexity from simply knowing that $2 + 2 = 4$, that the sun always rises in the east or what name to give someone or something, through to the complex knowledge of how something, like an internal combustion engine, a manufacturing process or complex supply chain works. To add further to its complexity, propositional knowledge also involves understanding how a change made to a system, such as those named above, will affect each one of its constituent parts.

Procedural knowledge, as its name implies, is the knowledge we use to act and includes such things as techniques, skills and the ability to successfully complete
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tasks. According to Stevenson (1991), procedural knowledge can be classified into three levels or orders. Stevenson’s first order of procedural knowledge is concerned with specific procedures. Specific procedures are those which we employ unconsciously (automatically) when we undertake tasks such as changing gears in a manual motor car, signing our names or doing up shoelaces. However, as they are specific to a particular task they cannot inform newly-encountered workplace tasks. For example, although the manual motor car driver may be adept at changing gears to suit speed and road conditions, this skill does not equip the driver to be able to select the appropriate gear in a four-wheel-drive in an off-road situation. For these types of situation, Stevenson identified second-order procedures. These are the procedures that we use to monitor and evaluate our strategy selection. We use these procedures to break work down into a series of sub-tasks which can be achieved by engaging in a means-end analysis. That is, in order to achieve so and so I must first do X … and so on, in order to work out ahead of time, which of the available options is the best approach to take to successfully complete the task. For example, continuing with the motor car theme, if I am driving a four-wheel-drive off-road and encounter a waterway I must consider several factors, such as how deep the water is, what type of surface I am going to cross, and what course I need to take to cross the waterway without incident. Once I have decided that our vehicle is suited to this particular situation and that the crossing can be made, then I need to decide what strategy to take to make the crossing safely. Consequently, a second-order procedure takes the form of the selection of high or low range, the most appropriate gear (and speed) and the best path across the waterway, all of which forms part of our process of monitoring and evaluating our strategy selection. These descriptions though, have involved the combination of both propositional and procedural knowledge,
suggesting that successful action in the world often (or perhaps, always), requires the successful combination of the two. As Anderson (1982: 391) argues, this is critical, since: “[T]he ability to perform successfully in novel situations is the hallmark of human cognition,” and as Billett, (2001: 53) points out, “It is these kinds of performances that establish particular individuals in the workplace as experts.”

Third, or higher-order, procedural knowledge is used to manage both first and second order procedures. It is this higher-order procedural knowledge which we use to monitor and organise our activities. Consequently it is a strategic form of knowledge and is particularly important when we are faced with novel situations, complex problems or the transfer of knowledge to new situations. In several instances in the cases described in Chapter IV, we will read of how people in a range of work situations have put these higher-order procedures to use.

To take this exploration of propositional and procedural knowledge further, I contend that we should rethink our understanding that propositional knowledge and procedural knowledge are static types of knowledge. I maintain that they should be regarded as properties of knowledge. That is, that rather than knowledge being either one, propositional, or the other, procedural, they are actually fluid and dynamic, capable of being either or both. With this view, what might normally be considered propositional knowledge, can, in action, become procedural. For example, in its simplest forms, propositional knowledge consists of the names we give things. This includes concepts such as left and right, up and down. However, when undertaking a task that requires turning left or right, or going up and down, it changes its property from propositional to procedural. Rather than differentiating
between thinking and doing, perpetuating the Cartesian myth of the “ghost in the machine,” these particular properties become dependent on context, that is, what might be considered propositional becomes procedural, once applied or put into action. This particular view of knowledge problematises the subordination of procedural knowledge by propositional knowledge by blurring the distinction between the two. This is discussed and explained further in Chapter IV.

2.2.2 Two states of knowledge

To explain the epistemological states of knowledge, Nonaka and Takeuchi draw on Polanyi (1966) and his distinction between tacit and explicit knowledge. Polanyi used the term ‘proximal’ to describe knowledge that was most likely to be tacit and ‘distal’ to describe that which is most likely to become explicit. In this sense proximal knowledge is that knowledge which is closest to us. It is personal, context-specific, difficult to formalise and communicate and consequently is tacit. On the other hand ‘distal knowledge’ is less personal, is more general, is easily codified and communicated and consequently explicit (Nonaka and Takeuchi 1995, Polanyi 1966). Therefore, as Polanyi so succinctly put it, tacit knowing is “knowing more than one can tell” (Polanyi 1966: 8).

But if left explained like this, tacit and explicit knowledge appear to be dichotomous, two quite different and perhaps opposing states where knowledge is seen as either one, explicit, or the other, tacit. This is not the case. As Nonaka and Takeuchi (1995) explain, knowledge constantly changes state, depending on both the individual and social circumstances. As people engage in creative activities with others, tacit and explicit knowledge interacts and interchanges, one with the other.
This process of knowledge conversion is both interactive and spiral involving socialisation, externalisation, combination and internalisation.

Socialisation involves the exchange or passing on of one person’s tacit knowledge to another in such a way that it remains tacit (Nonaka & Takeuchi, 1995: 62-4). This is achieved through the sharing of experiences such as one might see in the pairing up of a novice with an expert so that the novice, through a process of observation, imitation and practice, can acquire specific job-related skills. Externalisation, the process of converting tacit knowledge to explicit knowledge, occurs when we are able to articulate tacit into explicit knowledge through the development of concepts, metaphors, hypotheses or models that we are able to express in language, image or symbols. Due to this process of making the tacit, explicit, Nonaka and Takeuchi (1995) describe externalisation as a quintessential knowledge-creating process. Combination is the exchange and combination of different bodies of explicit newly created knowledge, by individuals, with their existing explicit knowledge, via a wide range of media including documents, meetings and computer-mediated conferencing, and so on. This process results in the sorting, classification and reconfiguration of existing knowledge into new knowledge. Internalisation, the conversion of explicit knowledge to tacit knowledge, occurs when our experiences are internalised within our tacit knowledge bases. This occurs when we learn by doing, or when we re-experience our own or others’ experiences through verbalising or diagramming these experiences into documents or oral stories (Nonaka & Takeuchi 1995: 61-70).

Thus, for Nonaka and Takeuchi, tacit knowledge is knowledge that we have internalised, or what Polanyi called proximal knowledge. It is this closeness that
makes tacit knowledge difficult, but as explained above, not impossible, to define and describe. One might consider the metaphor of a visible object. If it is too close we are unable to focus clearly on it making it difficult for us to distinguish but as it moves further away, we are able to focus more clearly and its form eventually becomes clear.

2.2.3 Knowledge and disposition

While the concepts of knowledge described above are useful in helping to explain how we acquire and use knowledge, they cannot explain human behaviour. For instance, how can friendly, helpful service, or the enduring dedication of a craftsman, or woman, be explained by our understanding of the types, or states of knowledge? While there is no doubt that skills can be learned, it is their continuing practice at a consistently high level that is difficult to explain simply through our understandings of knowledge and how it is acquired. These types of behaviour are probably best conceptualised as being influenced by attitudes, values, interests and identity associated with work, or more succinctly, as Billett (2001a: 53) explains: “[d]ispositions determine whether an individual values a work task enough to engage in the effortful process required to learn that knowledge.” By ‘disposition’ I mean a person’s innate interest in, and inclination towards, certain types of activities and work as indicated by the dedication of a craftsperson or, indeed, behaviours indicated by the friendly, helpful service of a shop assistant.

Furthermore, dispositions may also determine whether an individual will persevere with the application of a procedure, regardless of how uninteresting it may appear to others. Dispositions are an important factor in determining how we continue to
apply our knowledge, in as much as our dispositions direct our interests, they play an equal, if not larger, role in determining our willingness to continue to acquire and use certain types of knowledge.

2.2.4 Assimilation, accommodation and justified true belief

According to Choo (1998: 5-8), the central information activity is to resolve ambiguity. This is achieved by asking questions like: What is happening? Why is it happening? And, what does it mean? Choo claims:

…sense making is done retrospectively since we cannot make sense of events and actions until they have occurred, and we can then glance backward in time to construct their meaning (Choo 1998: 5).

To make sense of our environment, current events are compared with those from our past and through this process we construct meaning. Thus organisations, or rather the individuals in them, are viewed by Choo as sense-making systems, whose goal it is to create and identify events that recur for the purpose of stabilising their environments and thus make them more predictable. Therefore a sensible event is one that resembles something that has happened before (Weick 1995, 170; cited in Choo, 1998: 5).

For Piaget (1976: 111-2) sense-making is a question of overcoming ambiguity or disequilibrium, the unknown in what we encounter, through the processes of assimilation, that is, reconciling what we experience with what we already know, and accommodation, the creation of new categories of knowledge from our
experiences. Thus positioning thinking and learning as one process. Von Krogh et al. (2000a: 19-20) similarly explain assimilation as the process of integrating new yet congruous information into our existing knowledge, whereas accommodation is the process of giving meaning to new, but perhaps incongruous, information, distinguishing it as something outside our current store of experiences. When accommodation becomes too challenging we become uncomfortable with it, raising barriers and producing an emotional response that will prevent this new information from being accepted. Our justified beliefs are normally built up through a chain of events, each subsequent link reinforcing those prior to it. When we are presented with information that is radically different from our current justified beliefs then our ability to accommodate it may break down. The more difficult new information is to accommodate, the more stressed and uncomfortable we feel and in some instances we may simply reject this new information, preferring our existing, more comfortable and more acceptable paradigm. For example, at present there is broad debate, both nationally and internationally, on climate change. This debate has two clearly-defined premises: the first is that the Earth’s climate is changing, and the second, that this change is a consequence of CO$_2$ produced by humans. There is significant scientific evidence to support both, however, there is still a sizable body of people who reject either one or both propositions.

This raises some very important questions about how new knowledge is developed in, and introduced into, workplaces. While establishing or developing new knowledge, through an inductive process, may be an acceptable practice for philosophers and theorists, in the workplace the justification of a true belief must be achieved deductively through an empirical, sensory, process. In the workplace
“practical knowledge” is king. What is proposed in the workplace must work when applied, otherwise it loses its utility and consequently its value. Knowledge that is derived through an empirical process will have value because it can be applied “practically” while knowledge that is wholly theoretical has no proven utility and is of dubious value. It has no basis in practice.

Workplaces are social systems most often structured around functional groups consisting of both leaders and followers. Introducing new information into such a group can create tensions between the justified beliefs of either or both the leaders and followers, particularly if the new knowledge is introduced from outside of the group. Tensions between the various parties, the change agent who has introduced the new idea, the leaders who may perceive this new information as a threat to their existential selves, and, likewise, the followers who may or may not accept the new information, may also result. This is particularly the case if this new information seems, at least at face value, to be of little or no practical value to one or both parties.

Knowledge is an essential aspect of modern work. Many “workers” are now involved in what has been commonly referred to as knowledge work, thus bringing knowledge and its creation to prominence in fields that may not have been previously considered knowledge work, for example, manufacturing and the trades. Once the protected domain of managers and professionals, in today’s highly competitive and dynamic global economy, the creation of new workplace knowledge is frequently devolved through an organisation, as can be seen in structures such as work or project teams, quality ‘circles’, or programs like suggestion schemes.
As indicated above, Western philosophers since the time of Plato have settled, more or less, on the understanding that knowledge should be defined as justified true belief. This implies that individuals will justify the truthfulness of their beliefs based on their own interpretations of their observations and that these interpretations are, in turn, dependent on a combination of an individual’s unique perspective and his or her collected experiences. This definition personalises knowledge so that what might be knowledge, that is, a justified true belief, to one person may not be to another. Thus our knowledge becomes part of our existential selves. That is, we use what we know to define who we are; consequently new knowledge, quite literally, has the capacity to change who we are. However, the more deviant new knowledge is from our established understandings of ourselves and our environment, the less likely we are to accept it.
2.3 Judgement and Decision Making

... Judgment and decision making are pervasive, important intellectual activities engaged in by all of us ... throughout every day. The ability to form good judgments and make wise and effective decisions generally is considered the mark of a successful person in the smaller as well as the larger matters of living. Apparently the same has been true of every human society (Connolly, et al. 2000: 2).

To understand judgement and decision-making, we should first note how these terms have been defined. Quoting from Webster’s Third International Dictionary, Connolly et al. (2000: 1) tell us that “judgment is the mental or intellectual process of forming an opinion or evaluation by discerning and comparing and the capacity for judging is the power or ability to decide on the basis of evidence.” They go on to say that “Although the dictionary quotes E. L. Godkin as saying that “judgment is the highest of human faculties,” it also notes that Oliver Wendell Holmes said, “some of the sharpest men in argument are notoriously unsound in judgement.” They conclude their brief study of the term’s meaning by stating that “Apparently, we are to understand that the capacity to make sound judgments requires not only intelligence but wisdom and the former does not guarantee the latter.” Beckett and Hager (2002: 41), rather than talk about judgement per se, refer to ‘practical judgement’ and describe it as the making of “decisions about what to do next to bring about the most efficacious result – being the ‘practical’, or appropriate, contextually-sensitive solution to whatever the issue or problem.”
Matlin (2005: 403) defines decision-making as assessing and choosing among several alternatives, adding that there are no clear cut rules to tell us how to proceed from information (our alternatives) to the conclusion (our decision). Choo (1998: 11) describes decision-making as being able to “choose from among available options or capabilities” which results in the commitment to “a single strategy.” However, he also tells us that to be able to do this, one must have the “understanding and knowledge to act.” Connolly et al. (2000: 1) again, referring to Webster’s, provide a definition of decision, as “the act of settling or terminating … by giving judgment. They go on to declare that: “there is little difference between judgement and decision making in ordinary discourse, so we shall not make a distinction here.”

### 2.3.1 Judgement and bounded rationality

When making judgements people may make inductive inferences. For example, Neuro-Linguistic Programming (NLP) practitioners use facial cues, such as the position of the eyes to determine whether or not a person is being creative (eyes to the right) or recalling from their memory (eyes to the left) and there are those who believe that a person’s body language can tell us if we are liked (presenting and open position), or perhaps, disliked (presenting a closed position) (O’Connor and Seymour, 1994: 29). But inductive inferences such as these, based on behaviour, are characteristically founded on uncertain cues that can deceive (Connolly et al. 2000: 621).

To understand how humans make rational inferences about unknown aspects of the environment, Gigerenzer & Goldstein (1996 in Connolly et al. 2000) argue that we must consider three approaches. First, the classical view, that laws of human
inference are the laws of probability and statistics. Second, the heuristics-and-biases view that concludes that human inference is systematically biased and error-prone, and the third, that focuses on the psychological and ecological, rather than on logic and probability. This third view questions classical rationality as a universal norm, and thereby questions the very definition of “good” reasoning on which both the classical and the heuristics and biases views were built. It draws on the work of Herbert Simon, who proposed looking for models of “bounded rationality” instead of classical rationality (Connolly et al. 2000: 621-2).

Choo (1998) and Connolly et al. (2000) draw on the work of Simon (1956, 1957, 1976, 1977 and 1982) and his model of “bounded rationality” to describe how psychological and ecological factors influence judgement and decision-making, arguing that:

… information-processing systems typically need to “satisfice” rather than “optimize.” Satisficing, a blend of sufficing and satisfying, is a word of Scottish origin which Simon uses to characterize algorithms that successfully deal with conditions of limited time, knowledge, or computational capacities (Connolly 2000: 622).

As a consequence of bounded rationality, the organizational actor behaves in two distinctive ways when making decisions. First, he or she satifisces – looking for a course of action that is satisfactory or good enough rather than seeking the optimal solution. … Second, organizations and organizational actors simplify the decision process – routines, rules and heuristics are applied in order to reduce uncertainty and cope with complexity (Choo, 1998: 12).
By bounded rationality, Simon is referring to the constraints placed on an individual’s decision-making by their cognitive capacity, their knowledge (justified beliefs), and the information available to them, as well as their values. He criticises routines and standardised procedures (rules) for causing organisational stasis and inertia, while acknowledging that organisations do use them to simplify and guide individual decision-making (Choo, 1998: 13). Connolly et al. (2000) go on to explain that:

His [Simon’s] concept of satisficing postulates, for instance, that an organism would choose the first object (a mate, perhaps) which satisfies its aspiration level, instead of the intractable sequence of taking the time to survey all possible alternatives, estimating probabilities and utilities for the possible outcomes associated with each alternative, calculating expected utilities, and choosing the alternative which scores highest (2000: 622-3).

As stated earlier, Simon’s notion of bounded rationality has two sides: one, cognitive which emphasises the limitations of real minds; and the other, ecological, emphasising that minds are adapted to real-world environments. The two go in tandem: “[h]uman rational behaviour is shaped by a scissors whose two blades are the structure of task environments and the computational capabilities of the actor” (Simon, 1990: 7, in Connolly et al. 2000: 623).

2.3.2 Hot action, practical judgement and organic learning

Prevalent in everyday experiences at work, and life in general, are those processes and acts of judgement, embodied in ‘hot action’ from which adults learn. This
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The metaphor of ‘hot action’ is used by Beckett and Hager (2002) to describe acts of judgement, made in the instability of practice, that occur in both professional and non-professional work. As Beckett and Hager explain:

Such judgements mark out the very practice of professionals’ work, but to a certain extent all adult work activities (both paid and unpaid) have the element of discretion about them. What to do in the heat of the moment? How do I go on? What is to be done for the best? These questions occur every day in human practices, although they are rarely asked explicitly. Yet they require substantial judgements, made in the flux of practice, and these judgements contribute powerfully to epistemological claims about workplace learning … These judgements involve the whole of a person’s experience (by this we do not mean their entire life history, but the involvement of that person’s feelings and desires, wants and thoughts, and of course their embodiment) amidst the time across which the judgement and the heat of the action persist. This breadth and intensity of experience is, we argue, the basis for ‘organic’ learning (Beckett and Hager, 2002: 10).

Hot action is, therefore, the making of judgements within the often unstable flow of practice that answers the questions: What to do in the heat of the moment? What is to be done for the best? But perhaps, most importantly: How do I go on? Questions, that are asked, perhaps implicitly, in, rather than outside of (before or after), action. Beckett and Hager elaborate on this idea by stating that:
… all adults in their lives in general, both now and for the foreseeable future – as subjects of learning potential are best regarded as integrated thinking and doing beings who exercise all manner of judgements during the working day … (2002: 40).

For Beckett and Hager (2002: 41), judgements are practical decisions about what to do next to bring about the most efficacious result – the ‘practical’, or appropriate, contextually-sensitive solution. By adding the condition that a judgement be efficacious, that is, result in a contextually appropriate outcome, Beckett and Hager emphasise that: “In all cases of ‘practical judgement’, decisions about the ‘appropriate’ course of action are expected …” (2002: 37). This practical judgement has been likened to Aristotle’s phronesis or practical wisdom. Beckett & Hager (2002) explain the logic of practical judgement by telling us that:

[t]he key point is to return to the ‘whyness’ of know how. In practical matters, the purpose (the ‘why’) is to achieve what is efficacious, or appropriate, for that particular situation (or context). So intentionality is pushed a little harder: what is it about what we find ourselves doing which is purposeful? (Beckett & Hager 2002:59)

An important aspect of judgement therefore, is its intentionality or purposefulness. Judgement and consequently know how, is exercised when people intend to make a difference in what they are doing at work. In the workplace what is efficacious is also value adding. By this I mean that the workplace, somewhat like nature, abhors a vacuum, consequently the actions (and thoughts) of employees are required to “add value” to the enterprise and its endeavours towards achieving its objectives, be they
producing a product or providing a service, whether it be for profit or not. In these circumstances, judgements are themselves judged on their ability to contribute to the enterprise’s objectives.

Judgements must have practical outcomes that provide us with a means of going on. In this sense, judgements provide us with enabling solutions, as we work complex workplace problems through to a satisfactory, that is, practical conclusion. Accepting that the exercise of practical judgement is complex, and not always successful, Beckett and Hager go on to explain that:

Judgements about appropriate decisions … require the marshalling, or integration, of a range of considerations: technical, practical, strategic and personal. Gluing these together with professional competence is a complex and elusive achievement … (2002: 26).

Integral with and a product of practical judgement, is situated and embodied learning, or what Beckett and Hager (2002: 41) call organic learning. This organic learning involves the whole person acting in the world and includes both socially-located feelings and thinking (the cognitive and affective), and the appropriateness of what we are doing in a particular context.

This concept of learning is congruent with Jarvis (2006: 14), who saw the learner as a whole person acting in his or her “life world”. This is a socially immediate world, of both space and time, that includes all of the environmental, and contextual possibilities that this may summon, the learning experience, reflection on the learning experience, the emotions encountered during the learning experience, the
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learner’s actions based on his or her thoughts, and finally the changes the learning has made to the learner.

Important to our understanding of organic learning is what Dewey (1938: 67-72) referred to as ‘purpose’. For Dewey the formation of purpose though, is a complex intellectual operation, and involves observation, knowledge, and judgement. Observation involves our surrounding conditions and includes the environment and the context of our experiences. It also involves the significance of what we see, hear and touch. Our knowledge is the sum of our life experiences, and includes knowledge obtained partly by recollection, and partly from the information, and advice of those who have had a wider experience. This knowledge will provide us with some insight into the consequences, should we decide to act on what we see. Judgement pulls together what we know and what we observe and gives them significance (Dewey, 1938: 68-9). Without purpose, our judgements and learnings are meaningless. As Dewey explains:

A baby may see the brightness of a flame and be attracted thereby to reach for it. The significance of the flame is then not its brightness but its power to burn, as the consequence that will result from touching it. We can be aware of consequences only from previous experiences. In cases that are familiar because of many prior experiences we do not have to stop to remember just what those experiences were. A flame comes to signify light and heat without our having to expressly think of previous experiences of heat and burning. But in unfamiliar cases, we cannot tell just what the consequences of observed conditions will be unless we go over past experiences in our mind, unless we reflect upon them and by seeing what is similar in them to those now present,
go on to form a judgment of what may be expected in the present situation (1938: 68).

Purpose involves the formulation of a plan and method of action based on our understanding of the consequences of our actions. While our desire to achieve a goal may be intense, even so intense that it overrides our appreciation of the consequences of our actions, these impulsive actions provide for a poor, perhaps detrimental, learning experience. What is crucial to the efficacy of the learning experience is the postponement of immediate action, until observation and judgement have intervened (Dewey, 1938: 69).

Accepting that Connolly et al., Beckett and Hager, Matlin and Choo, all provide both adequate and complementary definitions of judgement and decision-making, I also acknowledge the three key propositions emerging from both concepts. The first is that, as Connolly et al., conclude, “there is little difference between judgement and decision making in ordinary discourse (2000: 1),” so like Connolly et al., I will not make a distinction either. The second, is that “the capacity to make sound judgments requires not only intelligence but wisdom” (Connolly et al., 2000: 1); and the third, that making judgements is about deciding on the ‘practical’, or appropriate, contextually-sensitive solution to whatever the issue or problem (Beckett and Hager, 2002: 41). It is also worthwhile noting that, while decision-making often requires choosing from available alternatives, this is not always the case. In several of the cases described below, as the subjects work on their problems, only solitary solutions emerge. In these examples, judgement is used to determine the viability of the ‘emergent’ solution. It is also noteworthy that, from the observations made of these
cases, like Matlin (2005: 403), I have found no clear cut-rules that tell us how to proceed from information to conclusion. The role and importance of wisdom in the judgement-making process is a view also acknowledged by Beckett and Hager (2002: 37) although they use the term *phronesis*, meaning practical wisdom, a term which aligns with their use of the term “practical judgement.” This is a term which lends itself well to this study of making judgements, and of learning, as a consequence of one’s work.

Dewey also makes a significant contribution to our understanding of judgement, and its use, with his concept of purpose and the role that observation, knowledge and judgement play in his framework for decision making. Purpose implies intentionality, when we do something intentionally we do it with purpose. Using Dewey’s framework, judgements are not simply a culmination of cognitive processes, but a justification for action.
2.4 Learning

But what is learning? I shall begin this section by briefly reviewing some of the dominant theories of learning, firstly from the field of psychology, the earlier theory of behaviourism and then the more recent theories of cognitivism and constructivism. Secondly, I will briefly review several theories or models of adult learning, some of which will be in more common use than others. While andragogy is perhaps the best known and heutagogy the most recent attempt to provide a model of adult learning three other, perhaps more or lesser known models, such as Illeris’s three dimensions of learning model, Jarvis’s learning process, as well as Schön’s thinking on reflective practice, will also be discussed to offer both a broader base of understanding, and to contrast the various approaches and their foci.

2.4.1 Behaviourism

It was early last century when the American psychologist, John B. Watson, first coined the term ‘behaviourism’ (Smith 1998: 42). According to Watson, the inner workings of the mind were uninteresting and something of a distraction. What Watson believed to be the real object was scientifically observable and measurable behaviour. From the behaviourist perspective, the learner is a passive subject who responds to specific stimuli. According to behaviourist theory, there are strict causal chains which govern human behaviour, consequently, laws can be derived which will predict the expected response to certain stimuli.

There are two common forms of behavioural learning theory: classical conditioning, and operant conditioning. Classical conditioning is based on the work of Russian
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psychologist Ivan Pavlov. In his famous experiments with dogs, he observed the response of a dog to the presence of meat powder, which caused the dog to salivate, and described this process as an unconditioned response (salivation) to an unconditioned stimulus (meat powder). Pavlov then started to introduce the sound of a bell on a large number of occasions when the meat powder was introduced. The dog then became conditioned to salivate at the sound of the bell. He called this (the sound of the bell) the ‘conditioned stimulus’ and the consequent salivation the ‘conditioned response’. In human terms this sort of behavioural conditioning can be seen when an operator in an oil refinery responds to an alarm on his control panel. The alarm is caused by an abnormal process condition out in the field. The operator is not responding to the abnormal process condition, but rather a sound and flashing light associated with the abnormal condition. In behaviourist terms, this behaviour would be classified as a conditioned response. Interestingly, though, the same operator in the field, responding to his observation of the abnormal process condition (an unconditioned stimulus) would be producing an unconditioned response.

Operant conditioning is based on B. F. Skinner’s work and uses reinforcement to gradually bring about a change in behaviour. Here the role of the trainer is seen as ‘delivering’ or ‘transmitting’ learning by breaking down complex tasks (or behaviours) into a series of small, discrete steps, immediately rewarding the desired change in the trainee’s behaviour (Tusting & Barton 2003). In order to receive more rewards, the trainee (operant) tends to repeat the rewarded behaviour and consequently the new desired behaviour is reinforced. Behaviour modification, a variant of this approach, has also been used to address problem behaviours including habits and phobias.
In its earlier forms, Competency Based Training and Assessment was regarded by many VET practitioners, particularly those in the trades, as being purely behavioural and atomistic, in the vein of Skinner’s operant conditioning. From my personal experience and observations, the model used by the Australian Army since the 1970s for much of its ‘skill’-based training used an approach based on Skinner’s operant conditioning. When instructing soldiers in rifle and parade ground drill, such as saluting, and presenting arms, each task is atomised, that is, broken down into its smallest logical part. Each part or movement is taught separately and practised with the instructor providing the learner with feedback, reinforcing correct movements and correcting those that were not, until the instructor is satisfied that the movements are consistently correct, before moving to the next movement or skill.

Interestingly, though, while behaviourism was the dominant psychological (and educational) paradigm in the USA during the first half of the 20th century, Europe favoured the Gestalt, a theory of mind and brain that suggests that the operational principle of the brain is holistic with self-organising tendencies. In Gestalt psychology the emphasis is on the basic human tendency to organise what we see and learn, resulting in a whole that is greater than its parts. Gestalt psychology also criticised the atomistic approach that behaviourists had to analysing human behaviour and, of course, their failure to acknowledge context. Gestalt psychology also provided some interesting insight into problem-solving, emphasising the importance of insight as a means of relating seemingly unrelated parts of a problem and consequently allowing the problem to be solved (Matlin 2004: 6-7).
2.4.2 Cognitivism

Cognition, sometimes called information processing, is the acquisition, storage, transformation, and use of knowledge. Consequently cognition involves a wide range of mental processes every time we acquire, store, transform and use information (Matlin, 2005: 2). Cognitivist learning theory rejects the premise that learning can only be seen as changes in observable behaviour, recognising instead that learners process information differently and that learning can be a unique experience. Rooted in Gestalt psychology, cognitivism draws attention to the roles of individual, internal, information-processing and the significance of questions of perception, insight and meaning in learning. Based on their understandings of how the human brain processes information, theorists began to recommend that learning be provided in multiple types of media to maximise the unique processing skills of the learner, e.g., their visual, auditory and kinaesthetic abilities.

Cognitivism can trace its roots back to Aristotle who, as well as discussing the importance of mental imagery, proposed laws for learning and memory based on the acquisition of knowledge through experience and observation. However, contemporary cognitivism didn’t emerge until much more recently. Evolving out of behaviourist theories of learning through the work of behaviourist researchers such as Tolman, in the 1920s, and Miller and Dollard in the 1940s, contemporary cognitivism recognises the legitimacy of behaviourism, but also its limitations, particularly its inability to account for, and describe, the more complex mental processes involved in learning.
Situated cognition brings to focus the importance of context in what and how we learn. Advocates of the situated cognition approach to learning argue that our ability to solve problems is related to the specific context in which we learn to solve a given problem. Matlin adds that:

> The traditional cognitive approach to thinking emphasises the processes that take place inside a person’s head. The situated-cognition approach argues that the traditional cognitive approach is too simplistic, because in real life, our cognitive processes take advantage of an information-rich environment, supplemented by complex social interactions with other people. (Matlin, 2005: 370)

But complexity is itself experienced differently, such as by its engagement with expertise. Experts think and act differently from non-experts (novices). This particular type of thinking and acting is marked by both its effectiveness and efficiency, and is a consequence of the cognitive structures that experts develop as they are exposed to, and learn from, their practice. Cognitive structures tell us more than just how effective someone is at processing knowledge, they also provide an insight into the breadth and organisation of that knowledge. The knowledge bound in our cognitive structures is not only something that we draw on in our everyday lives but is effective in our dealings with more demanding activities such as learning new tasks and problem-solving, including the transfer of knowledge to new applications. Cognitive theory proposes that by applying our knowledge to these types of activities, our knowledge and consequently our cognitive structures, are developed further. Therefore, cognitive activities such as learning, transfer, and
problem-solving, are commonly associated with the use, testing, and modification or
development of these cognitive structures (Billett, 2001: 50).

The development and modification of cognitive structures, that is, developing the
breadth and organisation of knowledge, through its application to new tasks, such as,
problem-solving, and the transfer of knowledge to new applications, is of some
importance to this dissertation, in particular, the development and modification of
cognitive structures during, or as a consequence of, problem-solving.

2.4.3 Constructivism

While behaviourism treats the mind as a black box, and cognitivism appreciates the
mind as a processor of information. It is constructivism, and in particular social
constructivism, that tells us the learner is much more actively involved with the
environment, and those in it, in the creation of new meanings. According to
Doolittle and Camp (1999):

> Preparation of workers for entry into and advancement in the workplace of the
next decade requires an educational program that provides not only job skills,
as career and technical education did …, but also higher order thinking,
problem solving, and collaborative work skills. Classical behaviourist theory
does not adequately address the latter kinds of learning, but constructivist
theory might (Doolittle & Camp, 1999: 1).

Constructivism is a philosophy and theory of learning that is based on the premise
that learners actively construct their own knowledge and meaning by reflecting on
their experiences. Through constructivist approaches to learning, the learner builds his or her own mental models or representations which they use to make sense of their experiences. Personally interpreting their experiences based on both their new and previous knowledge, learners build an internal representation of knowledge. As such, constructivism recognises learning as an active process that is always changing. As new knowledge is acquired, the learner “constructs” new meaning, therefore emphasising the importance of learning in context and collaborative exercises to encompass multiple perspectives (Armor, www, 2007).

Drawing on the work of Argyris, Senge (1992: 175) referred to mental models as capable of being quite simple and general or complex and specific: “But what is most important to grasp is that mental models are active – they shape how we act” (italics in original). Senge went on to explain that according to Argyris “[a]lthough people do not [always] behave congruently with their espoused theories [what they say], they do behave congruently with their theories-in-use [mental models].” Plotkin (1997: 150) used the term ‘schemas’, which he described as cognitive structures that generate and shape action, that in turn, are changed and shaped by the action itself. Schemas are highly flexible, and while they may begin as relatively simple constructs, they can become more complex as we add to them through our experiences. Building on these ideas, Piaget (in Plotkin, 1997: 151) argued that we know something by incorporating it into our cognitive structures (assimilation) yet this very act of incorporation can change our schemas or mental models and consequently our view of the world, creating an endless, dynamic exchange between the knower and what is known.
This process of assimilation and accommodation can be likened to Argyris and Schön’s (1978) single loop and double loop learning. In single loop learning, our mental models remain unchanged, but with double loop learning they, and consequently our view of the world, is changed as well.

The role of mental models or schemas in learning is further advanced by Jarvis, in section 2.3.9 below, through what he calls “biography.”

2.4.4 Types of learning

Hodkinson and Rainbird et al. (2000: 4-6) have identified four types of learning: type (i) The intentional/planned learning of that which others already know; type (ii) Socialisation into an existing community of practice; type (iii) The planned learning to do that which has not been done before; and type (iv), The unplanned learning to do that which has not been done before. Of these four types of learning, types (iii) and (iv) are of most interest to this study.

Type (iii) learning, the planned learning to do that which has not been done before, is often described in the literature as the management of innovation or change, rather than learning (Hodkinson, P., H. Rainbird et al. 2000: 6). My experiences of this type of learning sometimes involved individuals but most often teams or groups, in what might be described as “Action Learning” programs. When the precise nature of the learning needed is not known in advance, action learning is used to embark on intentional or planned learning for the express purpose of using the combined knowledge and experience of the group to initially identify the problem then develop
practical strategies to solve it, enabling the group and consequently the organisation in which they work to move forward or ‘go on’.

Type (iv) learning, the unplanned learning of that which has not been done before, happens when we, either as individuals or groups, confront new challenges as a continuing part of our everyday work (and private) lives. While the answers may sometimes be available in the wider world, they are not, at least consciously, known to the learner(s). To the learner the situation is novel, perhaps because of a unique setting or set of circumstances. These situations occur when during the normal course of work, one is confronted with a novel and often unique situation. The situation represents a barrier to be overcome if the work (and the worker) is to go on.

From the descriptions of the two learning types above, we can see that the learning is situated in the learner’s work, it is active as opposed to passive, and it is intentionally focused on going forward. In order to go forward problems need to be solved, through making practical judgements and decisions. What is also significant in these circumstances is that the consequences of these types of learning not only change the learner, but the wider world in which he or she works. Beckett and Hager (2002) add further to our understanding of this type of learning by stating that:

What psychologists call ‘situated learning’ is the most powerful workplace learning, because humans are immersed in their daily activities, from which they are especially susceptible to learning. Such immersion involves the totality (the ‘wholeness’) of experience, which, as we noted at the outset, is central to such learning: understanding, feelings, and with whom this occurs –
the sociality of the workplace – are each intertwined therein. (Beckett & Hager 2002:41).

While Hodkinson and Rainbird describe four types of learning, Hager (2000b) describes two learning theories, Theory I “the standard paradigm of learning” and Theory II “the emerging paradigm of learning”.

Theory I can best be summarised as follows:
- the best learning resides in individual minds not bodies;
- the best learning is propositional (true, false; more certain, less certain);
- the best learning can be expressed verbally and written down in books etc.;
- the acquisition of the best learning alters minds not bodies;
- such learning can be applied via bodies to alter the external world.

Critics of the standard paradigm of learning and its impact on education and learning cite its excessive individualism; its devaluation of non-propositional learning; its focus on intellectual understanding to the neglect of its application and the setting up of dichotomies and hierarchies, e.g. the theory/practice dichotomy (Hager 2000b).

The emerging paradigm, Theory II, might be seen as the antithesis of Theory I and companion to Hodkinson’s et al. type (iii) and (iv). Whereas in Theory I learning might be characterised as somewhat passive, in Theory II it is active, resulting in learning that will not only change the learner but also the wider world in some way.
Hager takes the case for the emerging paradigm of learning (Theory II) by discussing four contributors, (i) Dewey; (ii) the role of action in learning; (iii) insights from Wittgenstein; and (iv) the capacities presupposed by learning.

For Dewey, a noted critic of dualisms such as theory/practice, thought/action, etc. learning and knowledge are closely linked to successful action in the world. While accepting that concepts and propositions are important, he incorporated them into a broader construct called judgement. For Dewey, judgement is an integrated concept that embraces the cognitive, ethical, aesthetic, conative and other factors that are omitted from the essentially cognitive Theory I.

According to one commentator on Dewey:

… the point of a judgement is to make a difference in the existential conditions which give rise to the inquiry of which the final judgement is the termination. Changes in wider existential situations may involve alterations of mental states and attitudes, since mental states and attitudes are also existential. But to ignore the wider existential situation and to focus exclusively on mental states and attitudes is to open the door to the prospect of pure fantasy. (Hickman 1998 in Hager 2000b: 6-7).

The role of action in learning further differentiates Theory I from Theory II by defining learning as being intimately bound up with action, and as a process of thinking and acting and drawing conclusions (Jarvis 1992 in Hager 2000). Insights from Wittgenstein’s later philosophy are also highly relevant to Theory II since he provides us with an understanding of the formation and use of patterns while also
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arguing that meanings are created collectively in the public domain, rather than in and by the individual.

There are two key contributors to Hager’s thoughts on capacities, Passmore (1980) and Honderich (1998). For Passmore capacities are perhaps the major class of human learning and in normal cases every human being acquires a number of capacities for action but, although they are important to human learning, not all human learning consists of capacities. He argues that while all human learning may not rely on capacities, the mental enrichment seen in Theory I actually depends on the exercise of learned capacities (Hager 2000). Passmore distinguished two types of capacity, Closed and Open:

A ‘closed’ capacity is distinguished from an ‘open’ capacity in virtue of the fact that it allows of total mastery. Examples include playing draughts, starting a car etc. … in contrast, however good we are in exercising an ‘open’ capacity, somebody – or ourselves at some other time – could do it better”, e.g. playing the piano (Passmore 1980:40 in Hager 2000).

Honderich defined capacity as the “… power or ability (either natural or acquired) of a thing or person, and as such one of its real … properties”. He goes on to contrast the natural, dispositional, capacities of inanimate objects such as that of copper to conduct electricity, to the voluntary, and strictly non-dispositional, nature of human capacities, thus making capacities vital features of human learning. Hager (2000b: 9) goes on to suggest that “the argument is that capacities are basic for other kinds of learning. That is the mental enrichment seen as basic in Theory I actually depends on the exercise of learned capacities.” Hager summarises Theory II as follows:
It has a holistic integrative emphasis that aims to avoid dualisms such as theory/practice, thought/action … etc. … judgements as both reasoning and acting, incorporate both sides of these ubiquitous dualisms. Thus this learning paradigm does not reject as such any pole of these dualisms. For instance there is no rejection of propositional knowledge. Rather, propositions are viewed as important sub-components of the mix that underpins judgments – though the range of such propositions extends well beyond the range of disciplinary knowledge. What is rejected is the view that propositions are timeless, independent existents that are the epitome of knowledge. By bringing together the propositional with the doing, Theory II continually judges propositions according to their contribution to the making of judgements. Because the judger is immersed in the world, so are propositions. So they lose their classical transcendental status. (Hager 2000b:10)

Theory II’s emphasis on learning and action has important implications for this study because, as will be seen in the cases below, informal workplace learning is embodied in action. In today’s workplace, dominated by the drive to improve productivity, Dewey’s “successful action in the world” is interpreted as value adding action. This is because the success of the action would be determined by its ability to contribute, positively to the goals, and ultimately, the profit of the workplace. Contemporary approaches to the world of work often embrace concepts such as Lean Production, where any action that does not produce value for the organisation is considered waste.
2.4.5 Knowles’ Andragogy

As stated earlier, andragogy might best be described as a set of characteristics that can be used by facilitators of adult learning to inform their practice. Andragogy’s six characteristics and their underlying assumptions are:

1. The learner’s need to know: Adults need to know why they need to learn something before they agree to learn it. Consequently, at the very least, facilitators of adult learning need to make an intellectual case for the value of the learning.

2. The learner’s self concept: As a person matures, his or her self-concept moves from one of dependency to one of self-direction. Hence, according to Knowles, “[a]dults have a self-concept of being responsible for their own decisions, for their own lives” (Knowles et al., 2005: 65).

3. The role of the learner’s experiences: As people mature, they accumulate a growing reservoir of experience that becomes an increasing resource for learning.

4. The learner’s readiness to learn: As people mature their readiness to learn becomes oriented increasingly to the developmental tasks of their social roles. The critical implication of this assumption is the importance of timing learning experiences to those developmental tasks.

5. The learner’s orientation to learning: As a person matures his time perspective changes from one of postponed application of knowledge (up front learning in advance of the need) to immediacy of application (just-in-time learning for the task at hand), and accordingly his orientation toward learning shifts from one of subject-centredness to one of problem-centredness.
6. The learner’s motivation to learn: While adults are responsive to some external motivators (better jobs, promotions, higher salaries, and the like), their most potent motivators are internal pressures (the desire for increased job satisfaction, self-esteem, quality of life, and the like). Tough (1979) found in his research that all normal adults are motivated to keep growing and developing, but this motivation is frequently blocked by such barriers as negative self-concept as a student, inaccessibility of opportunities or resources, time constraints, and programs that violate principles of adult learning.

(Adapted from Knowles et al. 2005: 64-9)

While Knowles developed these six characteristics to promote the need to provide a more effective approach to teaching adults, they may well be applicable to learners of all ages. At face value, it is easy to accept that adults come into a learning activity with both a greater volume and a different quality of experience (Characteristic 3) from that of the young, but it would be naive to assume that children and youths come to such activities with no previous experiences, or that those experiences are of lesser value or consequence than those of adults.

A study of Australian primary school children in 2007, revealing the 307 words most relevant to children’s writing in their first three years of schooling, found that the most commonly used word was “I” (Lo Bianco & Baillie 2008). While not conclusive, this study indicates what might be considered a strong sense of self, even at a very young age. Consequently, it might be reasonable to assume that a learner’s
concept of self should be considered for younger as well as adult learners. These ideas are supported by Smith (1996, 1999) where he states:

Both Erikson and Piaget have argued that there are some elements of self-directedness in children's learning (Brookfield 1986: 93). Children are not dependent learners for much of the time, quite the contrary, learning for them is an activity which is natural and spontaneous' (Tennant 1988: 21).

Regarding the young learner’s need to know (Characteristic 1), readiness (Characteristic 4), orientation (Characteristic 5) and motivation to learn (Characteristic 6), I would argue that even young learners possess at least some small interest in things and consequently a need to know, based on these interests. Young learners possess a readiness, motivation and orientation to learn all things, but perhaps a greater readiness, motivation and orientation to learn those things, in which they have an interest.

I suggest that the strength of each of these characteristics may well develop as one advances through life, and that the practices of teachers of students of all ages, might benefit from considering each of these characteristics in all of their students. Might it also be appropriate to consider that learners, regardless of their age, demonstrate, more or less, each of these characteristics, depending on their particular life circumstances and histories?
2.4.6 Hase’s Heutagogy

While pedagogy and andragogy take a teacher-centred approach to learning, heutagogy, first introduced through the seminal work of Hase and Kenyon (Ashton & Newman: 2006), provides us with a learner-centred approach which is based on the thesis that adults learn from a full range of life experiences, and that educators must be guides to the development of ideas, rather than force-feed the wisdom of others. Underpinning this idea is the claim that learning would be more effective, at least for adults, if the control of the learning was handed from the teacher to the learner. Therefore, the core idea of heutagogy is the notion of self-determined learning (Hase & Kenyon, 2000, 2001; Hase, 2003; Coughlan, 2004; Ashton & Newman, 2006), which embodies the notion that the adult learner should be able to assume responsibility for determining what needs to be learned, and how to go about acquiring the experiences that are necessary, for developing the desired knowledge, and skills. In pursuit of this goal, heutagogy is therefore also concerned with how to harness the learning that occurs as a part of a person’s total life experience (Davis & Hase, 2001). This incorporates all aspects of a person’s life including their home and personal life, schooling, and, of course, their work life.

Often associated with lifelong learning (Hase & Kenyon, 2000; Davis & Hase, 2001; Hase, 2003; Coughlan, 2004; Ashton & Newman, 2006), heutagogy has also been interpreted, by some, as an information and communications technology (ICT) or e-learning-centred approach to learning (Ashton & Newman, 2006). This shifts the learning environment from the classroom to the PC, perhaps assuming that the World Wide Web, and ICT in general, is the most likely source of information available to the heutagogical learner. According to Ashton and Newman (2006),
through the use of ICTs, the ‘heutagogue’ becomes a knowledge broker using ICTs in what has for many, in developed countries, become a technologically resourced world.

Pedagogy, andragogy and heutagogy each provide us with approaches to teaching and learning which cover a continuum of learning theories or models that take us from one extreme, that of the somewhat Gradgrindian teacher-centred approach that some would define as pedagogy, to the self-determined and life-long learning, learner-centred approach, more recently put forward as heutagogy. However, while both andragogy and heutagogy shift their foci from the teacher to the learner, it is only heutagogy that stakes a claim as a truly learner-centred model. Both andragogy and heutagogy make their educational claims exclusive to adult learners, yet historically, educators as far back as Plato, and somewhat more recently Dewey and Lindeman, advocated a learner-centred approach, based on active rather than passive inquiry, and not just for adults, but for all learners (Conner, 2004). Of the three, it is heutagogy that most emphasises the role of conscious experience, that is, active inquiry in one’s own learning.

But perhaps heutagogy and andragogy’s greatest weakness, is their blinkered focus on the adult learner and, at least for those living in the developing world, its assumption that “information is readily and easily accessible” (Hase & Kenyon, 2000), a concept embraced by Ashton and Newman (2006), in their ICT-based heutagogical approach to learning. A further weakness of this ICT-based version is that it somewhat limits one of heutagogy’s key characteristics, that is, its claimed
humanistic, person-centred values, involving the harnessing of learning that occurs as a part of a person’s total life experience.

2.4.7 Illeris’ Three dimensions of learning

Illeris’ three dimensions of learning model takes an holistic approach to learning. Diagrammatically represented as an inverted triangle within a circle (see Figure 1, Merriam, et al., 2007: 98), this theory shows a dynamic relationship between the two dimensions of cognition and emotion, at the top, and the third, environment, at the bottom of the triangle, with all dimensions enclosed within a social context represented by the circle.

Figure 1: Illeris’ three dimensions of learning

According to Illeris, all learning is dynamic and occurs within a social context. And as Merriam (2007) explains:

Cognition and emotion are internal processes that interact simultaneously in the acquisition of knowledge or skills … environment … is the dimension of external interaction, such as participation, communication and cooperation. It
serves as the personal integration in communities and society and thereby also builds up the sociality of the learner (Merriam et al. 2007: 97).

This dimension explains our interaction with, or contributions of, other people as we learn. The model also emphasises the social context in which we live and operate while learning.

Illeris also identifies the “raw material”, or five stimuli, which can begin the learning process, and these are:

- Perception – where the surrounding world is directly sensed by the individual.
- Transmission – where someone else passes on information or transmits specific perceptions or messages.
- Experience – while it can include both perception and transmission its use is limited “so that experience presupposes a particular activity, that is, that the learner is not simply receiving but also acts in order to benefit from the interaction.”
- Imitation – “when the learner attempts to imitate or model another’s actions;”
- Activity or participation – where “the learner is engaged in a goal-directed activity sometimes participating with others as in a community of practice” (Illeris, 2002: 119-121; Merriam et al. 2007: 97-8).
These five stimuli “should not be regarded as separate, but rather as characteristics which can be combined in a single learning event, each of them being more or less present or prominent in a pattern unique to the specific situation” (Illeris 2002: 227).

This model and its description of the interactivity between the three learning dimensions of cognition, emotion and environment within the context of society – the environment in which the learning is occurring – can be of some considerable value to educators. Its inclusion of the emotional and environmental dimensions can be used to understand resistance to, or rejection of, learning, while the five stimuli can contribute to the development of a variety of classroom-based stimuli suited to the subject, the learners and the learning environment. However, to assume, as Illeris does, that all learning occurs in a social context overlooks those occasions (and I believe there are many) when learning occurs in an individual who is not connected to a social environment. One who might be struggling independently with a problem that must be solved if he or she is to go on, but, who by either design or circumstance, is unable or unwilling to engage with others. This view is supported by Jarvis (2006: 24) who argues:

Significantly, Illeris (2002: 29) also discussed three dimensions – cognition, emotion and society – and it is with the last that I disagree. For him the learning person is cognition and emotion and these occur within society – he omits the individual activity through which we also learn.

While a social element may be both desirable and beneficial to the learner, it is not always practical or available. There are many occasions in life and work, where people find themselves in novel situations that involve no one, other than themselves, in the successful solving of problems.
2.4.8 Communities of practice

Communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic and who deepen their knowledge and expertise in this area by interacting on an ongoing basis (Wenger et al. 2002: 4).

The work of Lave and Wenger has contributed much to our understanding of situated cognition. To them, situated learning is more than simply learning by doing, it is an integral and inseparable part of social practice (Lave & Wenger 1991: 31):

In our view, learning is not simply situated in practice, as if it were some independently reifiable process that just happened to be located somewhere; learning is an integral part of generative social practice in the lived-in world (Lave & Wenger, 1991: 35).

To explain their view of situated or more specifically socially-situated learning, Lave and Wenger use the term ‘Legitimate Peripheral Participation’ to describe the type of learning that occurs within communities of practice. For them:

A community of practice is a set of relations among, persons, activity and world, over time and in relation to other tangential and overlapping communities of practice. A community of practice is an intrinsic condition for the existence of knowledge, not least because it provides the interpretive support for making sense of its heritage. Thus, participation in the cultural practice in which any knowledge exists is an epistemological principle of learning (Lave & Wenger 1991: 98).
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Having initially described this form of socially situated learning as legitimate peripheral participation, Lave and Wenger (1991) go on to describe the process a learner uses when acquiring and mastering skills as ‘centripetal’. In this centripetal process the learner moves from the periphery of a practice towards its centre as a skill is first observed, learned, then practised, until the learner becomes proficient and is considered ready to learn the next skill, returning to the periphery again to observe, learn and practise a new skill. This learning dynamic is repeated until the learner has learned all that he or she needs to know in a particular field, such as an apprenticeship.

It is this centripetal process that I find most interesting and informative about the learning processes that Lave and Wenger describe. But what is most curious, is the scant attention paid to this motion through the learning process by the authors. By emphasising the peripherality of the learner and the learning process, the centripetal motion from periphery to centre and back out again is almost completely overlooked. Yet this is a far more useful description of the situated-learning process that they themselves describe, and is particularly useful, in understanding the learning process that they are trying to explain.

Lave and Wenger’s descriptions and discussions of Legitimate Peripheral Participation centre on the ‘social’ dimension. Many contemporary learning environments, particularly those in workplaces are ‘socio-technical’ rather than strictly social. In these environments, learners interact with either or both the social and technical dimensions, quite often, but not always, in order to develop a technical skill. Rather than participation in this socio-technical environment being limited to
that which is legitimate and peripheral (appreciating that Lave and Wenger describe peripherality as being dynamic, and the learner moving from the perimeter into the centre and out again); perhaps participation could be better described as collaborative, inquisitive and systemic?

In fact, Lave and Wenger’s emphasis upon learning’s sociocultural nature seems to completely ignore the socio-technical dimension. That is, the work (leisure or otherwise) dimension which involves the relationship between people (socio) and machines (technical), of all types and level of sophistication. Emphasising the whole person and the social and cultural contexts in which they exist is entirely appropriate, however, we must not exclude, or seem to exclude, technology, and its artefacts, from the learning environment.

Therefore, I believe that legitimate peripheral participation is both enlightening and problematic. While helpful in understanding the nature of situated, and in particular, work-based learning, principally in terms of its sociopolitical and sociocultural dimensions, their preference for the use of ‘peripheral’ to describe what is, in practice, ‘centripetal’ is, in some respects, confusing. Primarily, this confusion stems from the quite different meanings that can be attributed to the term once the concept of centripetal is understood and applied. Peripheral and centripetal are two quite different words with quite different meanings.
2.4.9 Reflective practice – learning by doing

In the varied topography of professional practice, there is a high, hard ground overlooking a swamp. On the high ground, manageable problems lend themselves to solution through the application of research-based theory and technique. In the swampy lowland, messy, confusing problems defy technical solution. The irony of this situation is that the problems of the high ground tend to be relatively unimportant to individuals or society at large, however great their technical interest may be, while in the swamp lie the problems of greatest human concern (Schön, 1987: 3).

In the passage above, Schön captures the essence of this dissertation, the fundamental difference between, on the one hand, technical rule-following (technical rationality), practised on the high hard ground and embodied in research-based theory and technique, and, on the other hand, learning by doing, that is, the making of new knowledge through the solving of what are often messy and confusing problems, encountered in the swampy lowland of professional practice. In this section I will briefly explore Schön’s work on reflective practice, and in particular, his thinking on reflection-in-action and knowing-in-action.

Knowing-in-action, which may also be described as technical rule-following, is tacit. It is a response to a situation or event that is spontaneously delivered without conscious deliberation that, so long as the situation falls within the boundaries of what we have learned to treat as normal, produces expected outcomes. This is also consistent with our understanding of assimilation, outlined above, where an individual encounters something new and will, in an attempt to make sense of the
situation, compare it with technical rules from their profession or other events from their past. If this new situation can be reconciled with what is already known then it is assimilated. Technical rule-following can also be compared to Simon’s bounded rationality, discussed above, where an individual’s decision-making is constrained by, amongst other things, the knowledge and information available to them, which includes, routines and standardised procedures.

Technical rationality is, according to Shils (1978 in Schön, 1987: 3) an epistemology of practice that is derived from positivist philosophy, and built into the very foundations of the modern research university. Schön explains that:

> Technical rationality holds that practitioners are instrumental problem solvers who select the technical means best suited to particular purposes. Rigorous professional practitioners solve well-informed instrumental problems by applying theory and technique derived from systematic, preferably scientific knowledge (1987: 3-4).

However, when our technical rule-following produces an unexpected result, we are surprised. It is this surprise encounter that causes the learning practitioner to reflect-in-action (Schön, 1987: 28). The role of reflection-in-action is to question our assumptions regarding our knowing-in-action. We think critically about the assumptions that brought us to our current situation, and we may, in the process, restructure our strategies and understandings of the phenomena, or our ways of framing problems relating to the phenomena that we are experiencing, but, its purpose is to reshape what we are doing while we are doing it (Schön: 28).
Reflective practice puts the learner at the centre of the learning process as a learning practitioner, that is, someone practising their “profession or craft” and learning from and through their practice. To explain reflective practice, Schön, using Dewey, tells us that a learner cannot be taught what they need to know, but he can be coached.

He has to see on his own behalf and in his own way the relations between means and methods employed and results achieved. Nobody else can see for him, and he can’t see just by being ‘told’, although the right kind of telling may guide his seeing and thus help him to see what he needs to see. (Dewey, 1974:151 in Schön 1987:17).

With regard to coaching, Schön tells us that: “In the absence of talent, some coaches believe, there is little to be done; and if there is talent in abundance, it is best to keep out of the student’s way” (Schön 1987:17).

According to Schön (1987: 4-5) when a practitioner sets or ‘constructs’ a problem, he does so by selecting and naming the things that comes to his attention, and will “name and frame” problematic situations in different ways, depending on his disciplinary background, organisational roles, past histories, interests, and political/economic perspectives. This understanding is entirely consistent with Jarvis’ concept of biography, where a person’s whole of life experience shapes the way a problem is initially perceived and ultimately dealt with. What Schön brings to our attention, and consequently adds to our understanding of problem solving, is the practitioner’s process of naming and framing messy and indeterminate situations so that they can construct a well-formed problem that can then be solved. Schön, building on Simon’s “bounded rationality,” also describes how differing disciplines,
roles, histories, interests, and political/economic perspectives, influence how individuals will frame problematic situations. And while he is generous in what he includes as influencers, according to Schön, it is the individual’s disciplinary background, be it doctor, engineer, economist or something else that dominates the framing process. My view here, which will be explored in the cases in later chapters, is that while one’s disciplinary background may have significant influence over how a problem is initially approached through a technically rational perspective, once down in the swamp, technical rationality is of little use. And as Schön explains:

Because the unique case falls outside the categories of existing theory and technique, the practitioner cannot treat it as an instrumental problem by applying one of the rules in her store of professional knowledge. The case is not “in the book.” If she is to deal with it competently, she must do so through a type of improvisation, inventing and testing in the situation strategies of her own devising. (1987: 5)

It is this “improvisation, inventing and testing in the situation” that is a key feature of many of the cases described in Chapter IV.

2.4.10 Learning as a process

Jarvis’ learning process provides us with a continuous model of learning that, like Illeris’, takes a dynamic and holistic view. This view of learning involves the learner as a whole person, in the world. To Jarvis (2006: 14) the world of the learner is what he refers to as their “life-world.” Rather than the whole world, the learner’s life-world is a world of both space and time that consists of his or her immediate
environment in which people and things interact. This includes all of the
environmental and contextual possibilities that this may summon, such as, the
learning experience, reflection on the learning experience, the emotions encountered
during the learning experience, the learner’s actions based on his or her thoughts as
well as any changes the learning has made to the learner. According to this model,
the learning begins with “a disjuncture between biography (all that a person is at a
particular point in time) and experience – an incident that, at the time, a person is
unprepared to handle” (Jarvis, 2006: 100). This disjuncture occurs when the sum of
our experiences (our biography) is unable to provide us with the information we
need to continue when something we are unfamiliar with is encountered. We are
unable to cope with the situation and are consciously aware that we do not know
what to do. Jarvis explains that: “We have to think, to plan, or to learn something
new. Learning then, always belongs with experiencing (Jarvis, 2004: 93 in Merriam,
2007: 100).”

According to Jarvis, learning involves all five senses, sight, touch, smell, sound, and
taste, and that “our learning is ultimately dependent on our body and biology is a
significant factor in the learning process – not because of our genes, but because of
the way our senses function” (Jarvis, 2006: 13). For Jarvis all learning occurs within
the existential world of the learner, a world that is ever changing and as the
individual learns, he or she is changed by their learning. As Merriam explains:

The learner is more than a cognitive machine. The learner is a whole person
made up of the mind and the body and comes to a learning situation with a
history, a biography that interacts in individual ways with the experiences that
generates the nature of the learning (Merriam, 2007: 101).
Jarvis himself summarised the model, and his definition of learning, by writing:

I now regard human learning as the combination of processes whereby the whole person – body (genetic, physical and biological) and mind (knowledge, skills, attitudes, values, emotions, beliefs and senses): experiences a social situation, the perceived content of which is then transformed cognitively, emotively or practically (or through any combination) and integrated into the person’s individual biography resulting in a changed (or more experienced) person (Jarvis, 2006: 13; italics in original).

Apart from its cyclical and holistic approach to learning, what Jarvis’ model also does is provide an insight into human learning. While pre-adult learners, particularly the very young, have a less developed cognitive ability, and by virtue of their youth fewer experiences, and consequently a “biography”, that is not as diverse nor as rich as that of an adult learner, they still do have both a cognitive ability and biography, which while limited, is being continually developed and enriched by their life and learning experiences. Consequently, Jarvis’ model can be applied, with some expectation of success, to learners from a broad range of ages and experiences, not just adults. Jarvis himself seems to have deliberately chosen to adopt the term “human learning” in an attempt to interest educators from all sectors. Therefore, according to Jarvis:

… learning is a very complex and lifelong process. This means that we should not seek to regard children’s learning, for example, as necessarily different from adult learning – even though there may be different processes and it occurs in different social contexts (Jarvis, 2006: 4).
Dewey (1916), as we noted earlier, also saw learning as a process. For Dewey, the overriding principle is that the good life for humans is one in which they live in harmony with their environment. But because the environment is in a state of continuous flux, so humans need to grow and readjust constantly to it, so as to remain in harmony with it. Thus, for Dewey, education must instil the lifelong capacity to grow and to readjust constantly to the environment. Since, argued Dewey, that reflective thinking as well as inquiry, democracy, problem-solving, active learning, experiential learning and so on, are methods that are necessary for humans to learn to readjust effectively to the environment, then these are the teaching and learning methods that must feature in education. Dewey also argues that reflection is central to effective inquiry and problem-solving, but this should not be seen merely in narrowly rational terms. For Dewey, reflective thinking is more holistic, incorporating social, moral and political aspects of the contexts in which it occurs (Hager, 2003: 5).

### 2.4.11 Learning and the individual

It is not my intention to enter into an extended discussion of existentialism or to explore its relationship to learning in any depth. My purpose here is to simply introduce and briefly explain existentialism as it relates to Jarvis’, and, to some extent, Beckett and Hager’s thinking on human learning.

Jarvis (2006: 3) describes learning as an existential process which is essential to our humanity, a fundamental stimulus for life itself. To appreciate fully the person-in-the-world, we should first take a moment to briefly explore the role of the person as a free and responsible agent, determining his or her own development through acts of
will. In particular, acts of will, in the context of this dissertation, are seen as both judgements, and as practice-based learning activities in which judgements occur. Jarvis’ use of the term “human learning” is a deliberate attempt to differentiate or separate it from that of organisational learning, which he sees as a misuse, and depersonalisation, of learning. While he accepts that there are similarities between aspects of human learning and organisational change and that organisations may have a life of their own, they do not have experiences. The claim is that learning is about experiences, usually conscious experiences, and as only individuals have experiences, consequently, it is only individuals that learn.

While much has been written about organisational learning, it has been rightly pointed out by Merriam et al. (2007: 43), and others, that organisations do not learn, only individuals do, and while much of an organisation’s knowledge may be codified, much of it is also vested in its people, who, over the course of time will come and go, consequently changing the sum of an organisation’s knowledge. Similarly, it is individuals who make judgements and decisions, both in their personal and organisational lives. Jarvis goes on to say that:

To use learning to describe organisational processes is to try to de-humanise something that lies at the heart of humanity itself, of personhood, and while it may reflect the tenor of this age, using the term in this way deprives learning of something fundamental to itself (Jarvis, 2006: 4).

As we can see, to Jarvis, learning is innately human and personal, involving the whole person in-the-world. This relationship between the person and their world will be encountered in each of the cases described in Chapter IV below.
Another existential aspect of learning that I will briefly explore is the Cartesian dualism of mind and body. As we have already discussed, Jarvis explains the learning process as involving the whole person, body and mind, where the person has an experience which he or she then transforms cognitively, emotively or practically (or a combination of all three) and then subsequently integrates this experience into their individual biography resulting in a changed person (Jarvis, 2006: 13). This particular view of learning therefore rejects the Cartesian mind-body dualism in favour of a more holistic person-centred approach. As Beckett and Hager explain: “It is the person, not merely the mind, which is significant, and persons are inevitably embodied” (2002: 40).

2.4.12 Informal Workplace Learning

Recently, workplaces have been gaining prominence as places of learning rather than simply a place where one applies knowledge acquired formally through recognised institutions of learning such as schools, TAFE colleges and universities. Researchers and authors such as Lave and Wenger, Nonaka and Takeuchi, Beckett and Hager, Choo, Billett, Jarvis and many more, have all contributed to our understanding of workplace-based learning, and, in particular, informal workplace based-learning.

Traditional institutional learning, structured on-the-job learning, and informal workplace learning, are three types of learning that are commonly found in workplaces. Traditional institutional learning deals with learning that occurs formally in educational institutions, schools, universities and TAFE colleges. Structured on-the-job learning does not always result in the formal recognition of the knowledge and skills acquired, however, it is provided with the intention of
somehow enhancing the learners’ productivity in the workplace. While traditional institutional and structured on-the-job learning are widely seen as being the more valid, or recognised, of the three, this study is primarily concerned with the learning that occurs informally in workplaces, through day-to-day dealings with workplace issues. These dealings are not primarily intended as learning opportunities. Indeed, many of those involved may not even be consciously aware that they are learning. This is because of the traditional association of ‘learning’ with formal or institution based ‘education’. As Hager (1998) explains:

An important obstacle to workplace learning being taken seriously as part of someone’s education is its difference on many criteria from traditional ‘educational’ activities. This is most obvious in the vast differences between workplace learning and typical learning in educational institutions, but workplace learning is also very different from on-the-job training.

(Hager, 1998: 525)

Hager (1998) also argues that formal learning is intentional and controlled, in most cases by both the expected outcome, which is determined by curriculum or criteria and, also by the teacher or trainer. Consequently, outcomes are predictable and explicit, which in turn, makes formal learning relatively easy to assess. The focus is on such teaching, or even ‘on-the-job’ training, which is largely directed at the individual, that is, what the individual will learn in the form of knowledge (theory) or skills (the application of theory), with the greater effort placed on teaching or training for the acquisition of knowledge. Formal learning is also often decontextualised, emphasising the general over the specific, and, as mentioned earlier, relates principally to explicit propositional knowledge.
By contrast, informal learning is often unintentional, with no formal curriculum and no clear criteria. Here, the intention is to solve a problem so that work can proceed to its logical conclusion. Because of its situatedness, informal workplace learning often blends seamlessly with the learners ‘normal’ work making it difficult to separate out and identify. Informal learning may also be entirely incidental, so consequently, explicit outcomes are elusive. In addition, informal learning is often implicit, with the learners frequently unaware of what it is they have learned, making assessment, and the recognition of such experiences as learning difficult.

While formal learning can often be collaborative, informal learning can be more so, because it arises incidentally, in the sociality of the workplace. With groups of colleagues working together to solve problems or remove impediments to progress, informal workplace learning often makes the learning experience site-specific, while the socio-cultural aspects of the learning also contribute to defining both the individual learners’, and the group’s, identities. Being less clinical than formal learning experiences, informal workplace learning often includes the affective, cognitive and social dimensions of the workers’ experiences as they go about their work together. This has important implications, as Hager explains:

No wonder, then, that for many involved in education the idea of workplace learning as genuine education is beyond the pale. If claims that workplace learning is educational are correct, then we appear to need a reconceptualisation of education. (Hager, 1998: 527)

In the case of informal workplace-based learning, the nature of the thing to be learned, and the environment in which this learning is situated, will determine how
we go about the task of learning. However, rather than being an artificial environment, and an abstract concept, such as that which might be found in the classroom, the workplace offers the learner concrete concepts embedded in an actual workplace environment. While a teacher may be able to manipulate a learning environment, by changing learning tasks, resources, contexts and experiences, to make it more conducive to a variety of learning strategies and preferences, the workplace often limits all of these to that which is both available, immediate and practical.

While we may think it appropriate to assume that informal workplace learning is somewhat ‘self-directed’, my preference would be to label it as task or goal-directed learning. As we shall see in the case studies that follow, the learner is working towards a goal or objective, but is not directing the learning, more specifically, he or she is being directed by the need to learn enough to be able to successfully complete a given task. What I am suggesting here is that the learner is not self-directed at all but rather, task-directed. That is, the learner’s primary motivating factor in many informal workplace learning situations is a need to acquire specific, task-related and highly contextualised knowledge, so as to be able to go on and complete his or her assigned task, rather than curiosity or a curriculum driven need to know what there is to know about a particular subject.
2.4.13 From Rule Following to Professional Artistry

There is general agreement that some professional performances are superior, but the problem is not that these performances cannot be recognised, but rather that they cannot be assimilated into the dominant models of professional practice. Outstanding practitioners are not said to have more professional knowledge than others, but more “wisdom,” “talent,” “intuition,” or “artistry.” Unfortunately terms such as artistry, elude conventional strategies for explanation and so tend to close off, rather than open up, enquiry (Schön, 1987: 13). Schön goes on to suggest that to understand the relationship between practice competence, and professional knowledge, rather than asking how to make better use of research-based knowledge, we should be asking what we can learn from a careful examination of artistry. That is, “the competence by which practitioners actually handle indeterminate zones of practice – however that competence may relate to technical rationality” (Schön, 1987: 13).

Rather than provide a better, or more insightful, understanding of how to use existing professional knowledge, the cases presented in Chapter IV are used to demonstrate how professional artistry is applied and that this artistry involves the putting aside of technical, and bounded, rationality, and the adoption of a more open and flexible approach, that not only allows for, but encourages, the reinterpretation of these “indeterminate zones of practice,” so that new and often innovative solutions can be crafted and applied.

The research presented in Chapter IV below will show that talented practitioner learners can be quite adept at learning by doing and solving the problems
encountered in the swampy lowlands of work-based practice, without the aid of a coach, or perhaps more appropriately, as their own coach. In the cases below, the coach is replaced by Dewey’s ‘purpose’ which independent learner practitioners use to guide their seeing, and thus, help them to see what they need to see.
2.5 Conclusions

Based on the analysis and discussion presented in this chapter, I make the following conclusions:

2.5.1 Knowing

- That knowledge exists as two broad types, *propositional* and *procedural*, and that these types are static, is contested. As are the claims that it is the ability to successfully combine only these two types of knowledge, that provide one with the ability to perform in novel situations, and consequently, establish individuals in the workplace as experts. My interpretation of the relevant literature leads to the claim that *propositional* and *procedural*, like *tacit* and *explicit*, are *properties*, rather than types, of knowledge, and that like, *tacit* and *explicit*, they exist in a fluid state, where, depending on individual, social and contextual circumstances, what is *propositional* becomes *procedural* and vice versa. Therefore, it is the ability to successfully combine these four *properties* of knowledge in novel situations that establishes particular individuals as experts in the workplace (Sections 2.1.1 & 2).

2.5.2 Valuing

- The literature shows that it is our disposition to knowledge, and the tasks associated with it, which will partly determine whether we value knowledge enough to engage in the effortful processes required to learn, and to practice the tasks associated with it. My interest is in the further claim, that our disposition to knowledge is closely related to the value we assign to it, and that, in the workplace, value is derived through the justification of a belief (knowledge) that is achieved deductively, that is, through an empirical,
sensory, process. Most would agree that in the workplace, to be valued, knowledge must be practical, it must work when applied, otherwise it loses its utility and consequently its value. What needs exploration is whether its value is justified by individuals on the basis of the truthfulness of their beliefs, that is, on their own interpretations. This has both profound and problematic consequences for both employers and educators (Section 2.1.3 & 4).

2.5.3 Judging

- The literature shows that judgement and decision-making involve similar processes, and that a distinction should not be made between the two (Section 2.2.2).

- Furthermore, given this similarity, bounded rationality influences our judgement and decision-making ability. My claim here is that satisficing, the process that allows people to successfully deal with conditions of limited time, knowledge, or computational capacities, is closely tied to their bounded rationality. Consequently, if one’s knowledge at the time, based on the information available, as well as one’s values, is sufficient for the task at hand, then satisficing will result in a successful outcome (Section 2.2.1).

2.5.4 Learning

- It is clear in the literature that behaviourism, cognitivism and constructivism all contribute to our understanding of learning. However, my claim is that these ‘isms’ fragment our understanding of learning, and that a holistic approach to learning, one that involves the whole person acting in the world, that is organic, contextualised and action-oriented, is the most appropriate
way to understand learning. It is this approach to learning that allows us to
develop the cognitive structures that help us to deal effectively with
increasingly demanding activities such as learning new tasks, problem
solving, and the transfer of existing knowledge to new applications (Sections
2.2.2, 2.3.2, 2.3.3 & 2.3.10).

- While I agree that andragogy and heutagogy both contribute to our
  understanding of learning, my claim is that they too, serve to fragment it,
  perpetuating the notion that learning between children and adults is
  substantially different. As neither andragogy nor heutagogy describe
  attributes that are exclusive to adult learning, my preference is to focus on
  pedagogy, or more specifically, multiple pedagogies, which provide us with
  approaches to teaching and learning that cover a continuum of human
  learning theories (Sections 2.3.4, 2.3.5 and 2.3.6).

- Relationships between our biographies, cognitive structures and our justified
  true beliefs provided by the literature are unclear. My claim here is that
  there are such relationships, and that clarity is provided through our
  biographies, made up of cognitive structures (sometimes called schema or
  mental models), which are, in turn, constructed from our justified true beliefs
  (Sections 2.3.2, 2.3.3, 2.3.4, 2.3.9 and 2.3.10).

- It is unclear how technical rule-following (technical rationality), embodied in
  research-based theory and technique, can succeed in the development of
  Schön’s professional artistry. On the other hand, organic and holistic
  learning by doing, presents itself as a process that is likely to develop such
  artistry (Section 2.3.9, 12 & 13).
2.5.5 Situating

- The common proposition that all learning occurs within a social context (Lave and Wenger, 1991 and Illeris, 2002) is contestable. While social interaction plays an important role in human learning, it (learning) is not dependent on it. Humans are quite capable of learning independently and in isolation from other humans. (Section 2.3.7)

- Lave and Wenger’s claim that the principal learning activity in communities of practice involves legitimate peripheral participation is problematic. Their description of a second process, that of centripetal motion, is more likely to be the principal learning process, as it describes the learner’s journey from the periphery (novice) of a skill to its core (skilled). (Section 2.3.8)
Chapter III

Research Design

(Methodology)
3.1 Methodology

Methodology is like a recipe with methods the ingredients, and like a recipe the ingredients must make a palatable whole. To some extent it is the methods that will justify the choice of methodology (Clough & Nutbrown 2002: 22). Overall though, it is methodology that provides the rationale whereby the understanding of our research is created (Miller & Brewer 2003: 192). According to Clough and Nutbrown:

A characteristic purpose of a methodology is to show not how such and such appeared to be the best method available for the given purposes of the study, but how and why this way of doing it was unavoidable – was required by – the context and purpose of this particular enquiry (2002: 17 italics in original).

This research has focused on people in workplaces who have dealt with novel work-based problems. The purpose of this research is the study of the use of practical judgement in the workplace, and the knowledge consequently generated at work, by people who encounter novel problems that must be solved if the work is to go on. Consequently, the methodology chosen must allow me, the researcher, to investigate and understand this knowledge-generating process from the ‘inside out’.

Accordingly, I have drawn on a form of interpretive inquiry, phenomenology. What I have sought is the ability to understand the phenomenon of knowledge creation and the role that practical judgement plays in its creation. This methodological approach has allowed me to record and interpret meanings from the phenomenon being studied. The next section describes my theoretical perspective.
3.2 Theoretical Perspective

Positivist inquiry applies the methods of the natural sciences, such as chemistry, biology and physics. In particular, it follows the methodological ideas of pre-twentieth century physics epitomised by Newtonian physics. Acknowledging that positivist methodologies have been successfully applied in the natural sciences, the postpositivist view is that these methodologies are not, in themselves, an appropriate way to study phenomena associated with the human sciences. Human beings possess characteristics that are fundamentally different from non-human phenomena such as those studied in the natural sciences. Primarily, human phenomena distinguish themselves from non-human phenomena in three distinct ways: consciousness, context that is natural rather than artificial, and culture (Caulley, 1994: 3). Consequently, inquirers into the human sciences have developed methodologies that are appropriate to the study of human phenomena. But human phenomena (consciousness and culture) imply experiences of reality and of how reality is come to be known. These are ontological and epistemological issues at the heart of any methodological choice. Even a non-science like law has developed the case method to deal with phenomena peculiar to law.

Ontology is concerned with understanding the nature or essence of the reality being studied; the real nature of whatever it is that constitutes the world (Cohen & Manion, 1994: 6; Schwandt, 2001: 157). Thus, the primary ontological question for researchers into human phenomena is: is social reality external to individuals – imposing itself on our consciousness from without – or is it the product of individual consciousness? My research acknowledges both ontological perspectives, but
methodologically, I take the latter (the individualistic) as my point of entry to the former.

Epistemology is concerned with knowledge, in particular, its nature and forms, how it can be acquired, how it can be communicated and how we know that we know (Miller & Brewer, 2003: 94). Thus, the primary epistemological question for researchers into human phenomena is: is knowledge hard, universal and capable of being transmitted in tangible form, or is it softer, more subjective, spiritual or even transcendental, based on experience and insight of a unique and essentially personal nature? (Burrell & Morgan 1979 in Cohen & Manion 1994: 6). In showing how epistemology and ontology are intimately connected, Clough and Nutbrown claim that:

In addressing a [research] task we do not immediately go to adopt this or that methodology as such; rather, we again confront specific problems which we come eventually to locate in continually related – rather than opposed – ways of construing the world. . . . Hence the idea of choice between broad approaches … is ultimately spurious and as Merton and Kendal (1986: 549) point out, the real choice is that combination . . . which makes use of the most valuable features of each. The problem becomes one of determining at which points they should ‘adopt the one and at which the other approach’ (2002: 15, italics in original).

Dewey (1938) further illuminates the issue of related rather than opposed ways of constructing the world by stating that:
in spite of itself any movement that thinks and acts in terms of an ‘ism becomes so involved in reaction against other ‘isms that it is unwittingly controlled by them. For it then forms its principles by reaction against them instead of by a comprehensive, constructive survey of actual needs, problems and possibilities (6).

This research project has appreciated the relatedness of methodological approaches, rather than their differences, and acknowledges (a) for individuals, learning is both a consequence of practice and that such practice consequently produces learning, and (b) that knowledge is both hard and universal, and soft and subjective. My choice of methods has also therefore, been able to acknowledge and accommodate these complex characteristics. I have effectively captured, recorded and analysed the stories told to me by my research subjects (as social realities worth knowing).

As stated earlier, this study has been an enquiry into the construction of knowledge through informal learning on-the-job, or what Schank (1994) calls “learning by doing”. I have just argued that dichotomous ontological and epistemological stances are not acceptable platforms on which to base this study. Rather than dwell on dichotomies which seem to demand that a researcher reject either one or the other, my preference has been to take a more flexible position, one that uses a fluid combination of the most valuable features of each, leaving me with the more tangible problem of deciding at which points I relate how learning is both a consequence of practice and that such practice consequently produces learning, and that in so doing, knowledge is both hard and universal, and soft and subjective, as I have stated above.
In leading into more detailed accounts of these relationships, it is important to discuss briefly how ‘learning by doing’ has been found.
3.3 Naturalistic and Qualitative Inquiry

In order to find data that would be of most use to this study and reduce the bias that a highly structured interview or questionnaire risks producing, as a question inevitably elicits an answer it was designed to produce, naturalistic inquiry has been used. Guba defines naturalistic inquiry as:

…a “discovery oriented” approach that minimises investigator manipulation of the study setting and places no prior constraints on what the outcomes of the research will be. …Open-ended, conversation-like interviews as a form of naturalistic inquiry contrasts with questionnaires that have predetermined response categories. It’s the difference between asking, “Tell me about your experience in the program”, and, “How satisfied were you? Very, somewhat, little not at all.” (Guba as cited in Patton 2002: 39-40).

In accordance with this position data collection through interviews was informal, unstructured and all lead questions were open-ended. While interviews can sometimes be seen as subjective and subject to bias (Bell 1993: 91, Cohen & Manion 1994: 247) they are an appropriate means of adding valid and ‘thick’ informant input.

The fluid and emergent nature of naturalistic inquiry makes the distinction between data gathering and analysis somewhat difficult to maintain. Whereas it might be easy to regard data collection and analysis as two distinct and asynchronous processes (as one might experience when using data collection instruments such as
surveys or standardised tests), in the course of naturalistic fieldwork, ideas about the course of analysis occur as patterns take shape and themes move from vagueness to clarity. These emergent ideas constitute the beginnings of analysis (Patton 2002: 436) which begins with the qualitative processes of organising, reducing and describing the data, and continues fluidly through the activity of drawing conclusions or interpretations from data (Schwandt, 2001: 6). Various metaphorical attempts to describe this process are as follows:

Stake (1995) writes of the art of case study research. Van Maanen (1988) emphasises the storytelling motif of qualitative writing. ... Golden-Biddel and Locke (1997) make story the central theme. ... Corrine Glesne (1999), a researcher and poet, begins with the story analogy, describing qualitative analysis as “finding your story,” then later represents the process as “improvising a song on the world.” Lawrence-lightfoot and Davis (1997) call to mind “portraits.” ... Brady (2000) explores “anthropological poetics.” Janesick (2000) evokes dance ... Hunt and Benford (1997) call to mind theatre as they use “dramaturgy” to examine qualitative enquiry. Richardson (2000) reminds us that qualitative analysis and writing involve us not just in making sense of the world but also in making sense of our relationship to the world and therefore discovering things about ourselves even as we discover things about some phenomenon of interest (Patton 2002: 432-3 emphases in original).

As Stake (1995: 72) put it, “Qualitative study capitalises on ordinary ways of making sense.” And as Patton (2002: 432) explains: “No formula exists for that transformation. Guidance, yes. But no recipe ... the final destination remains unique for each enquirer, known only when, and if, arrived at.” Naturalistic and
qualitative inquiry are linked. Seeking to make sense of my data I have examined and interpreted each ‘natural’ case, to firstly, determine what role, if any, practical judgement had played in directing each subject’s actions, secondly to identify the characteristics of the problem solving processes employed, and thirdly and finally, to qualitatively identify any new knowledge constructed by the informant as each story played out.

Within this context of natural, qualitative inquiry, I turn now to the detail of the relational approach I set out in 3.1 above.
3.4 Phenomenology

While its popularity has somewhat confused and diluted its meaning, phenomenology is primarily concerned with the essential meanings of individual experiences and focuses on exploring how human beings make sense of and transform experience into consciousness, both individually and as shared meaning. This requires the researcher to carefully and thoroughly capture and describe how people experience the phenomenon of interest – how they perceive, describe, feel about, judge, remember, make sense of and talk about it with others. Such data requires in-depth interviews with people who have a “lived experience” of the phenomenon (Patton, 2002: 103-4). Van Manen describes phenomenology as something that:

… aims at gathering a deeper understanding of the nature or meaning of our every day experiences. A person cannot reflect on lived experience while living through the experience. For example, if one tries to reflect on one’s anger while being angry, one finds that the anger has already changed or dissipated. Thus, phenomenological reflection is not introspective but retrospective. Reflection on lived experience is always recollective; it is reflection on experience that is already past or lived through. (1990: 9-10 in Patton 2002: 104, italics in original).

Van Manen’s understanding of retrospective reflection also has significant implications for this study with regard to Schön’s idea of reflection-in-action and how, if at all, reflecting-in-action, exists.
Phenomenology brings together the inseparability of the research and researcher, creating a dialogue between the two (Clough & Nutbrown 2002: 68) and in so doing, Oakley states that:

… the mythology of ‘hygienic’ research with its accompanying mystification of the researcher and the researched as objective instruments of data production [is] replaced by the recognition that personal involvement is more than dangerous bias – it is the condition under which people come to know each other and to admit others into their lives. (1993: 58 in Clough & Nutbrown 2002: 68)

In so doing, this dissertation is written in the first person. This will show that all observations and comments that are mine will clearly be mine, rather than a disembodied, and perhaps disconnected, third person researcher.
3.5 Collective Case Study and Methods

On the whole, the cases of interest in naturalistic and qualitative educational research are people and programs, with each one, similar yet unique. While my interest is in both the uniqueness and the similarity of their stories, my primary objective is to understand them. A case is a specific, complex functioning entity that can be intrinsic, instrumental or collective (Stake, 1995: 2-4). An intrinsic case is one in which our interest is intrinsic because we need to learn about that particular case. An instrumental case is one where our interest may be driven, for example, by a research question and that by studying a particular case we may gain the insights that we are seeking. If however, we feel that our interests would best be served by studying several cases, as is the case for this research project, then we would call the work a collective case study. These distinctions are made, not to categorise case studies, but because the methods used will differ.

Accordingly, since this research project has studied several specific problematic human phenomena, namely, educative events, or series of events, in the working lives of individuals, I regard this project as a ‘collective case study’ which will reveal the relational approach to methodology outlined in 3.1 and 3.2 as follows:

Case studies . . . are often seen as prime examples of qualitative research – which adopts an interpretive approach to data, studies ‘things’ within their context and considers the subjective meanings that people bring to their situation. (de Vaus 2001: 9-10 cited in Clough and Nutbrown 2002: 17)
Case study is not a methodological choice but a choice of what is to be studied. … We could study it analytically or holistically, entirely by repeated measurements or hermeneutically, organically or culturally, and by mixed methods – but we concentrate, at least for the time being, on the case. (Stake 2000: 435 in Patton 2002: 447)

As Stake explains above, case study is a choice of what is to be studied, that is, cases and it makes good sense to identify the smallest possible unit of analysis, or case, to study. As it is a particular phenomenon – the use of practical judgement in the generation and acquisition of new knowledge – that I have studied, then logically the cases studied should be events rather than individuals or groups.

In this ‘collective’ approach, each case focuses on a single ‘critical’ event or program recounting the story as told by the individual who experienced it, including all appropriate contextual information. Each one highlights an individual’s experiences with learning at work and through their work as they apply, more often than not, practical judgement to the novel problems they face. In the cases that follow in Chapter IV we study people as they make sense of their situations and make judgements for the purpose of clarifying and solving problems so that they may ‘go forward’.

3.5.1 Sampling and Data Collection

Case study research is not sampling research (Stake, 1995: 4). Cases for study are selected because they are “information rich” and offer useful demonstrations of the phenomenon of interest. Consequently, sampling is aimed at gaining an insight into
a phenomenon and while we cannot generalise from single cases or very small samples, we can learn from them – and learn a great deal, often opening up new territory for further detailed research (Patton 2002: 40-46).

A purposive or purposeful sample of subjects has been chosen from workplaces that I have access to, through my own work and professional networks. The samples have been chosen based on their topicality. That is, their ability to articulate the use of practical judgement as a key component of practice-based or informal workplace learning. Figure 2 below provides a chronological overview of the data collecting process.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Position</th>
<th>No. of I’views</th>
<th>No. of Cases</th>
<th>Interview Dates</th>
<th>Duration</th>
<th>Gross Word Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rob</td>
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<td>3</td>
<td>3</td>
<td>26th Sep 2004</td>
<td>00:07:23</td>
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<td></td>
<td>10th Oct 2004</td>
<td>00:04:25</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10th Oct 2004</td>
<td>00:05:40</td>
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</tr>
<tr>
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<tr>
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<td></td>
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<td>Jo</td>
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<td>00:23:33</td>
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</tr>
<tr>
<td>Juan</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16th Jun 2005</td>
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</tr>
<tr>
<td>Phil</td>
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<td>1</td>
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<td>1</td>
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<td>00:54:06</td>
<td>6462</td>
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</tbody>
</table>

Figure 2: Data collection and reduction
Of the subjects who agreed to participate in this study, three, known by the aliases, Rob, Chris, and Jo, were known to me through my earlier employment with a multinational chemical company. Two, who I have called Juan and Phil, I had come to know through my previous employer, Workplace Learning Initiatives, a private RTO. Prior to commencing this research I had observed and come to know the work of all five as I worked or interacted with them in their respective places of employment. My knowledge of their roles, career transitions and involvement in key assignments or projects suggested that they would be able to tell stories that would be rich and relevant to this research. The participant who I have called Liz was suggested to me by my wife, who knew of my research and who thought Liz would be able to make a worthwhile contribution. After an initial interview where it became obvious that Liz had several relevant experiences that could contribute to this study, she was also invited to participate.

All interviews have taken place under conditions chosen by and comfortable to the informants (Patton 2002: 39). Where necessary follow-up questions, to prompt or clarify, were used to ensure that all relevant information pertaining to the case in question was included and that the information provided for each case was understood by this investigator. All data was collected digitally using a Sony ICD-ST25 Stereo, voice activated, digital recorder and the files uploaded onto my Personal Computer using the Sony Digital Voice Editor 2 software package provided with the recorder. They were each stored as DVF formatted files into individually labelled folders, one folder for each informant, and given unique file names. All data was collected and stored between September 2004 and October 2005, a period of some 13 months.
3.5.2 Piloting

Piloting, to prove the recording equipment, my interview technique, and my ability to probe and clarify when necessary, was undertaken using the subject I have called Rob. These interviews produced cases 1, 5 and 6, which are all described in Chapter IV below.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Position</th>
<th>No. of V'views</th>
<th>No. of Cases</th>
<th>Interview Dates</th>
<th>Duration</th>
<th>Gross Word Count</th>
</tr>
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<td></td>
<td>10th Oct 2004</td>
<td>00:05:40</td>
<td>811</td>
</tr>
</tbody>
</table>

Figure 3: Piloting

The three interviews used to pilot my interview process were conducted in September 2004 (see Table 3 above). The first produced case number 6, the Plant Turnaround. This was followed-up a day later with two shorter interviews, which produced the LMS case, case 1, while the second, produced the compressor settings case. All are featured in chapter IV below. The four stages of the pilot process are described below as:

1. Familiarise the informant.
   a. brief on involvement and an explanation of his role as story teller and of the context of the research,
   b. provide a “Plain Language Statement” (see Appendix A.).

2. Prepare the informant
   a. informant asked to recall a situation or situations in which he was, or may still be, involved that placed him in “unfamiliar territory”,

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b. encourage informant to tell a story of the experience and its overall purpose for himself, organisation and/or business unit.

3. Conduct interview
   a. directed informant to focus on one specific problem or situation and allowed him to relate the story as best he could,
   b. refrain from interrupting and allow the informant to continue until he had finished,
   c. clarify and probe where necessary.

4. Debrief informant to:
   a. determine if the informant felt as though the interview technique used drew out the appropriate information,
   b. that the process enabled a relatively free flow of information, and
   c. to thank the informant for his time and cooperation.

The pilot demonstrated that preparing the subject through a pre-interview briefing proved an effective alternative to a predetermined set of interview questions. A predetermined and prepared series of clarifying and probing questions (see Appendix B), were also of no use as the process required questions that were specifically related to the story being told and the type of information required. While there was no longer an appropriate place for pre-set or generic questions, my own need to be able to probe and clarify effectively was highlighted. While the ability to probe and clarify is particularly important, the pilot allowed me to discover, somewhat unexpectedly, that their use may not be necessary in each interview.
Feedback from the informant and a review of the audio recording confirmed that both the technology and open interview process were able to reliably provide, capture and store my research data. The recorded data was successfully uploaded to my PC and transcription proved to be a relatively easy, though time-consuming process.

3.5.3 Data reduction and analysis

The interviews produced just over 280 minutes of audio which I then transcribed into 16 individual cases for a total of 30,528 words.

The first reduction involved reducing the number of cases from sixteen to a number that would be both suitable and manageable, i.e. a number that would provide sufficient data for the study yet allow me to keep within the word limits of the thesis. After transcribing and reading each of the sixteen cases, eight were selected for inclusion. Deciding which of the 16 cases to exclude was a difficult task but cases had to be cut. While each of the 16 cases told a story of informal workplace learning some were richer and fuller than others and it was from this group that the eight were chosen.

The second level of data reduction involved reading each case to ensure that each was a single unit of study. The first stage of this reduction involved reading each case thoroughly and identifying a ‘dominant theme’ that would become the unit of study. Secondly, using MS Word, words and phrases that were related to this dominant theme were marked by highlighting them. Using the ‘Font Color’ tool, this text, was coloured blue and then the case re-read to ensure that all of the material
related to the theme had been identified. The third process involved reading the case again, but this time looking for material that was not related to or contributing to the dominant theme. This material was coloured red. After re-reading the case to be sure its integrity would remain intact if the material I had coloured red was removed then it was deleted. Master copies of all interviews have been retained in the event that I should need to draw on this raw and unedited material in the future.

The third level of data reduction again involved editing each of the cases to remove extraneous text. At this stage, extraneous text included things such as ums, ahs and repeated or redundant materials. As the informants told their stories they tended to repeat words and phrases and use ums and ahs while gathering their thoughts or recalling their ‘place’ in the story if they happened to wander off course momentarily. Again using MS Word, words and phrases were marked for deletion by colouring them first. Words and phrases that were clearly extraneous, such as ums and ahs, were coloured red (for deletion) and those that were perhaps not so clear such as some repetitious or redundant materials, such as divergences from the subject, were coloured orange (for probable deletion). Transcripts were then read to ensure the integrity of the cases would not be lost or diminished if the text marked red for deletion was removed and once satisfied that it would not, then it was deleted. The case was then read again to check if the deletion of the text coloured orange would interfere with the integrity of the cases. Where it did not then it was deleted. Where it seemed as though it would then it was kept.

Once the extraneous text was removed a fourth level of reduction was employed which involved identifying any text that had gotten out of sequence as a result of
either the informant ‘leaping’ forward or backward through the story or as a result of the previous two reductions. In almost all cases, stories were told in a somewhat disjointed fashion where the telling of the story jogged the memory of the teller as the story was being told. This meant that text was sometimes out of context and had to be shifted, often backwards, to properly situate it. Reduction occurred if this process resulted in repetitions that had not previously been identified. The case was then read again to check that it was coherent. Where coherence was found to be a problem, passages, one at a time, were relocated and the case read again to check the coherence and integrity of the case. Cases were easily reverted to their previous condition through the use of the ‘Undo Typing’ tool. This process was repeated until I was satisfied that each case was presented as a coherent and intact unit of study. Finally, to contextualise each case, an introduction was written. Cases have also been arranged so as to lead the reader through a series of stories beginning with the simplest and ending with the most complex.

Analysis focussed on two key criteria: the use of practical judgement, and the construction of new knowledge. As explained above, by now, each case had been reduced to a single unit of study with a focus on these phenomena. Not only does this make each story the coherent telling of a knowledge constructing event, it aids analysis by removing what might be described as ‘noise’ from each case study. This made it a relatively simple task to initially, point such phenomena out and then to discuss and analyse the phenomena in the context in which it occurs.

Again the primary tool of analysis involved the use of coloured text. Instances of knowledge development were coloured blue and those of practical judgement were
coloured green. This process highlighted each of these phenomena in the case allowing an interpretation and analysis of each as either a knowledge, judgement or combined event. Relationships between knowledge and judgement events as identified in the research questions in Chapter I and repeated below are of prime importance to this study, consequently analysis focussed on these questions.

1. To what extent is informal workplace learning enabling people at work to acquire new, relevant and worthwhile, that is, value-adding, workplace knowledge and skills?

2. To what extent is purposefulness a key enabler in the development of this new workplace knowledge?

3. What are the key characteristics of this informal learning?
3.6 Trustworthiness

Because my research interest is instrumental and required a collective rather than intrinsic approach, issues relating to the restraint of curiosities and interests during the data collection and analysis were of lesser importance than they may have been if an intrinsic approach had been employed (Stake, 1995: 4). Interviews represent the primary source of data for this study, providing a source that is rich (thick), and relevant. Systematic data collection procedures, rigorous training, multiple data sources and other techniques used during this research, are aimed at producing high-quality qualitative data that are credible, trustworthy, authentic, balanced about the phenomenon under study, and fair to the people studied (Patton 2002: 52).

On question construction, Foddy (1993) makes the point that verbal data has been the keystone of contemporary social science and while the data collected is often of dubious validity and reliability, other kinds of data used in the social sciences are no more or less valid and reliable. To improve the ability of interviews to elicit more trustworthy data, Foddy (1993: 38) suggests that the researcher begin with a clear definition of the topic of enquiry and an equally clear idea of the information that is required. Consequently, prior to the commencement of fieldwork, both the type and nature of the topic of enquiry was clearly defined as was the required information. That is, that ‘case study’ was to be the principal research method; and that the cases were to be based on the individuals’ accounts of their own work experiences, being specific and bounded instances of the use of practical judgement, and the construction of new knowledge. In addition a pre-interview briefing paper in the form of a Plain Language Statement (see Appendix I) was developed and provided to all subjects prior to the interview and each subject was ‘screened’ to determine if
they were a suitable candidate, i.e. a short meeting was held (either in person or over the phone) to explain the research, the research method and to determine the willingness of the subject and how well they understood the requirements of the research interview process. A phenomenological approach requires sensitivity to both setting up, and carrying out ‘research’ conversations. This is because, as Patton states:

> Writing in the first-person, active voice communicates the inquirer’s self-aware role in the inquiry. … But voice is more than grammar. A credible, authoritative, authentic, and trustworthy voice engages the reader through rich description, thoughtful sequencing, appropriate use of quotes, and contextual clarity so that the reader joins the inquirer in search for meaning (Patton 2002: 65).

Through the use of voice, in particular that of the first person, of both the interviewer and the interviewed, and through the rich description, thoughtful sequencing, appropriate use of quotes, and contextual clarity of the cases presented in Chapter IV, I invoke their trustworthiness and invite the reader to join me in my inquiry. In support of my claim of trustworthiness, I have ensured that the voices of the subjects interviewed for this study are heard by including as much of their ‘authentic’ stories as each case allows.

Again, according to Patton (2002: 14), in qualitative research, the researcher is the instrument, therefore the credibility of qualitative methods hinges to a great extent on the skill, competence, and rigor of the researcher. As an instrument of both data collection and data interpretation, a qualitative strategy includes having personal
contact with and getting close to the people and the situation under study (Patton 2002: 50).

Neutrality is not an easily attainable stance, so all credible research strategies include techniques for helping the investigator become aware of and deal with selective perception, personal biases, and theoretical predispositions. Qualitative inquiry, because the human being is the instrument of data collection, requires that the investigator carefully reflect on, deal with, and report potential sources of bias and error (Patton 2002:52).

To provide the reader with some insight into and understanding of me as a research and analytical instrument, and of any potential sources of bias or error that may affect my research, I will, in the next few paragraphs, describe my background and my interest in this research topic.

Like many people in my age group my initial experiences of education included kindergarten followed by primary and then secondary school. Leaving secondary school after completing year ten, I commenced an apprenticeship in Boiler Making only to leave it six months later to join the Royal Australian Navy where I learned to be both a Seaman and what is nowadays called a Combat Information Systems Operator. After serving on Destroyers and some smaller craft I left the navy and quickly gained employment in the Petrochemical Industry as a Process Operator on a new and yet to be commissioned Styrene Monomer plant. It was whilst working in this industry that I first became involved in Vocational Educational and Training.
In 1992, several years after joining the company, I was invited to take on the role of Training Foreman for the Styrene Plant, a role that required that I return to school (after an absence of some 22 years) and complete an Associate Diploma in Training and Development, which I did. Rather than satisfying an interest it only served to intensify it. I wanted to know more and consequently enrolled for a Bachelor’s Degree, then a Master’s and now a Doctor of Education. It has been during this time, through both my work in VET, which has included several small qualitative and quantitative research projects, and my formal studies with the University of Melbourne that I have acquired and developed many of the skills used during this project. It was also during this time that I met, though the course of my work, all but one of the subjects that contributed to the cases described in chapter IV and while most would be classified colleague or acquaintance at least one, the one I have named Rob, would be called friend. In some circumstances this may be considered a source of bias or a risk to the trustworthiness of the data but in this case I would simply reiterate what I have stated elsewhere in this chapter, and that, as an instrument, I simply recorded the stories, without prejudice or bias, as they were told.

During my employment since 1992, I have worked several training related roles. While with my petrochemical employer I was a training foreman, a Human Resources then Senior Human Resources Consultant, primarily in training functions. Since leaving the petrochemical industry in 2000, I worked for a short period in recruitment, and then as a private training contractor. For approximately eight years I worked for a private RTO, initially as an Industry Consultant before assuming the position of Operations Manager. Most recently, I returned to industry where I am
responsible for the learning and development of 320 employees involved in the manufacture of glass containers. Also during this time my interest has shifted from how to teach people, to how people learn. Primarily, how people learn once they leave the schools and institutes where they acquired their formal education and in particular, how people learn from their work.

As a person who has been, and remains, responsible for managing and continually improving an organisation’s capacity to provide a high quality educational service to initially clients, and now employees, my interest in how people learn from their work has continued to grow. Consequently, many may consider my interest in the topic to be somewhat vested, and this, of course, is true. But the clients and employees with whom I have worked over the past 19 years, while diverse in both their industries and sophistication, are often time poor. Consequently, they are often unable to allocate the time required of traditional, classroom based, that is, Theory I or the ‘standard paradigm of learning’ (Hager, P. 2000: 2) sometimes also referred to as ‘up front’ learning. What I am not interested in though, is to prove that Theory II or the ‘emerging paradigm of learning’ (Hager, P. 2000: 6) works. I believe that has already been done by others. I seek to simply advance my understanding of this form of learning and in particular the role, if any, that practical judgement plays in this learning process, so that I, and others, can further advance our professional practice in the field of workplace based learning and development.
3.7 Ethical Considerations

In the context of research into a social science such as education, the primary concern is to protect the privacy, confidentiality, and anonymity of the research participants. There is also the issue of plagiarism, or the protection of the intellectual property of participants. For the purpose of this discussion I include in my definition of participant both the interviewees and their places of work as well as the authors of the texts and other materials used to inform this research project.

To protect the identities of interviewees who require anonymity, or to protect the identity of the organisations in which they were employed, a practical and commonly used approach has been taken. This involved the use of simple pseudonyms that are unrelated to either the name of the company or of the research participants. Heinman (2001, pp96-7) sums up the issue of research ethics as a concern for balancing a researcher’s right to study a behaviour with the right of participants to be protected from abuse. Cohen and Manion expand on this idea in stating:

> Ethical concerns encountered in educational research in particular can be extremely complex and subtle and can frequently place researchers in moral predicaments which may appear quite unresolvable. One such dilemma is that which requires researchers to strike a balance between the demands placed on them as professional scientists in pursuit of truth, and their subjects' rights and values potentially threatened by the research. (Cohen & Manion 1994: 347)

Cohen and Manion (pp347-54) identify two fundamental concepts, costs/benefits ratio and informed consent, which they describe as contributing to the bedrock of
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ethical procedure. The costs/benefits ratio is a process they suggest can be used to weigh up the costs of the research, in the form of personal costs to the individuals taking part in the research against the social benefits that the research is expected to produce. Informed consent is a process that ensures that the participants and the organisations in which they may be situated are adequately informed about the research so that they may make an informed decision about whether or not to participate, and the extent to which they are prepared to participate.

Taking these important factors into consideration the main costs or risks to participants associated with this research project related to issues of anonymity and confidentiality. It is the process of negotiating access and informed consent where these issues were raised and dealt with. Access to individuals and sites was negotiated and careful consideration was given to the extent to which conditions and guarantees were made with regard to:

1. Risks versus benefits of the research to the participants.
2. Need for anonymity.
3. Need for confidentiality.
4. Opportunity to verify statements and transcripts.
5. The provision of a copy of the final report.
6. Issues related to publication.
7. Need for debrief.

(Adapted from Bell 1993, p54 and Heiman, 2001, p101)

Each of the above points was addressed with individuals prior to their inclusion in the study. Rather than commit to guaranteed outcomes with relation to each of the
above six points, *a priori*, outcomes that conform to the University of Melbourne’s Ethics requirements were established. This approach ensured that all participants were fully informed.
3.8 Summary

In this chapter I have established that a qualitative methodology, engaging a phenomenological approach that draws on collective case studies, is suited to the research questions posed earlier in Chapter I. This involves the collection of rich, thick stories of people, and their learning journeys, as they encountered and, for the most part, learned new workplace skills and knowledge.

The collection of data spanned thirteen months, involved thirteen interviews with six people and produced sixteen separate cases, of which eight were selected for inclusion in this study. Even though I had known five of the six subjects of this study, this field work offered insights into their professional worlds that I had only previously glimpsed. It has provided varied accounts of their encounters with novel workplace problems and the methods they employed to initially understand, and ultimately, resolve them.

In the next chapter (Chapter IV), I present and discuss the findings from the stories collected by providing as much of the original voices of the people interviewed as possible. I have also used the first person narrative for myself to enable the reader to engage more personally with the material presented. It is through the discussion in this chapter that I lay the foundation for an understanding of the knowledge-making process, that I develop in Chapter V.
Chapter IV

The Individual

and Practice-based

Learning

(Findings and Discussion)
4.1 Introduction

In this chapter, centred on the individual and practice-based learning, we will read eight case studies that involve six people, Rob, Chris, Juan, Phil, Jo and Liz as they individually, and for the most part, independently, undertake workplace-based projects that, on the whole, involve only themselves as they confront, and then solve, workplace problems that they have not encountered before, and with which they have no prior reference points on which to base their decisions. In each case, our subjects can be observed applying practical judgement as they confront problems, which must be solved so that they are able to go on.

We look at practical judgement in hot action, as well as in what might be described, as cool action. That is, judgements that are made in the heat of the moment, where events are moving rapidly and time is critical to the decision-making process and outcome, as well as in situations of relative calm, where the temperature of the moment is cool and time pressure is less evident. Nevertheless, important, and often critical decisions, must be made in a timely and efficacious manner so that each of our subjects can achieve their goals. Throughout this chapter, we look at our subjects as they make crucial judgements that have to be made, if they are to be able to go on. We explore how they purposefully move their thinking, themselves, and their projects, forward, step by step, until they are able to successfully complete their assigned projects.

In this chapter, the eight cases are presented to introduce key ideas incrementally from the relatively simple to those that are somewhat more complex. Cases themselves also become richer in content, and consequently are more complex,
this chapter progresses. Each case is presented with interview transcripts, and accompanied by comments, findings and discussion from this researcher. Initial interviews were recorded digitally and later manually transcribed using Microsoft Word. Raw transcripts were reduced by eliminating this researcher’s questions, prompts and comments, and then further reduced by eliminating any extraneous materials recorded such as responses and comments from the subjects that were not related to the cases on which this research is based. Finally, the portions of the transcripts used, were corrected for grammar and punctuation.
4.2 The cases

Our first subject is Rob. Rob is the Learning and Development Manager for a multinational chemical company located in suburban Melbourne. Originally qualified as a tradesperson, Rob joined this organisation several years previously as a process operator on one of the company’s more sophisticated plants. After being promoted to the position of Training Foreman, Rob undertook and completed a Bachelor of Teaching. Highly regarded for his technical knowledge, clear thinking and problem-solving skills, Rob was again promoted, this time, to the position of Employee Development Manager. In our first of three encounters with Rob we look, in Case 1, at his attempt to secure the funding for a Learning Management System (LMS). This is a computer-based system for the delivery, tracking and management of training. When we next meet Rob, in Case 5, we find him in a production role, a temporary Plant Manager, where he is trying to supervise, and at times, negotiate, the plant start-up after a major maintenance project. On our third and final encounter with Rob (Case 6), he finds himself unexpectedly, in charge of a significant maintenance project where his challenge is to bring a multimillion dollar maintenance program in on time and on budget, despite never having the usual engineering background or experience.

Our second subject is Chris. Chris is a qualified chemist with some laboratory supervision experience. In Case 2, we meet Chris as he moves into a new role as a Plant Manager and soon discovers the political side of the job when, early one night shift, one of the plant’s teams, encounter a problem and ‘use it’ to test Chris’ ability to balance the plant’s production priorities, and the need to operate the plant safely, against the operator’s attempts to use the problem to lighten their workload.
Our third subject is Juan. Juan is a technically-minded man who owns and operates a small manufacturing company. While the specialisation of Juan’s company is the high volume production of jewellery for the retail market, Juan himself specialises in the design and manufacture of the tools, dies and machines that are used, by the employees in his factory, to make jewellery. In the case presented, (Case 3) we read how Juan conceived of, designed, and then built, a machine to make ear hooks. These are gold or silver hooks that thread through an ear piercing and to which an adornment of some sort is attached.

The fourth subject is Phil, a chemist and experienced research scientist, now working in private industry. In Case 4, Phil is put in charge of a small team charged with the development of a new production process. While the challenge may seem unremarkable to the outside observer, for Phil and the company he works for, the technical problems that must be overcome are quite significant: reducing the process time by as much as a half, and at the same time replacing a critical, natural raw material, with a synthetic one, while still retaining high standards in product quality.

The fifth subject is Jo. Jo is a newly appointed Health and Safety Systems Specialist tasked, in Case 7, with developing, and then implementing, a new site wide energy isolation system. New to the role, but not to the company, Jo first has to find out what changes need to be made to the existing system, then negotiate the design and implementation across a site of seven independent manufacturing plants with a group of uncooperative Plant Managers.
The sixth and final subject is Liz, a communications engineer, who, in Case 8, takes on a 2½ year contract assignment as an expatriate project manager in a major communications project in Indonesia. This is a first for Liz in several ways, she has never worked on such a large scale project, she has never lived and worked in Asia and she has never led a team of engineers who are all from a completely non-Anglo culture.
Case 1: Rob and the Learning Management System

As a key element in his Learning and Development strategy, Rob had determined that a Learning Management System (LMS) was needed. His reasoning was that the Learning Management System could be used to deliver most of the regulatory and plant technical training that the operators needed, directly to them, in their manufacturing units, during ‘normal’ operating hours. That is, twenty four hours a day seven days a week. The current practice was to limit all regulatory, and the bulk of plant technical-training activities, to between 9 a.m. and 5 p.m., Monday to Friday. The purchase and deployment of a Learning Management System would ensure that the theory components of all plant training requirements would be available for delivery on shift, at any time or day, reducing the reliance on the more time dependent and expensive trainer-delivered approach, and as a bonus, produce and maintain consistency of this training, and its records, across the business.

Based on his understanding of current practice and his previous experience with purchases of this kind, Rob completed and submitted a request for capital expenditure (Capex). As Rob explains:

> When I went for the LMS program, a new Learning Management System, my understanding of the process was one where I would personally look at some programs, talk to people, get some recommendations, and then say: “righty-oh then that’s the program we want to go for.” I would cost it, then I would put up a proposal to the General Manager and ask him to sign it. And that’s not what happened!
Rob had been the Employee Development Manager for several years and had undertaken several projects requiring a capital expense of the type he was planning. A new General Manager, with new ideas on how things like this should be done, had been appointed to the position only a few months earlier, and unfortunately, his and Rob’s expectations in this area did not align. The new General Manager wanted a business case to argue the business merits of the proposal, rather than what Rob had presented to him, which simply stated that a preferred model had been chosen from a number of options and how much it would cost, as Rob explains:

"When I went in there to do that, he said; “No, I won’t approve it). You’ll have to justify why we should spend that money and what value that program is going to give to the organisation, and prove to us that it is a viable decision.” That sort of threw me because it [the LMS] was something we needed so I didn’t bother justifying it in the sense that he wanted to justify it. So I said; “Yeah, not a problem, I’ll do that."

It’s important to note Rob’s dominant beliefs here. The first is that the Learning Management System was needed, and the second, that this is his decision to make. To Rob, no further justification was necessary, he was the Employee Development Manager, he had assessed the situation, and he had decided that a Learning Management System was a suitable solution to a long standing problem. However, the feedback from the General Manager suggested otherwise.

With these beliefs still largely intact, but with the General Manager’s feedback causing him some concern and confusion, Rob returned to his office to redraft his proposal. Rob was still thinking in terms of the old Capex process, rather than the
new one. To him, at this point, the process is still a relatively simple one that is essentially between him and the General Manager. Rob recalls that:

*I went away and put together a proposal and took it to him, and this time he said; “No! You haven’t proved it to me. You need to prove it to me. Why should we spend that amount of money on this system?” And I said; “Well if we don’t, there’s three things could happen. One, WorkSafe is going to come back and say your [training] records are a mess. They’re all over the place. You’ve got records in the database sitting in the Gatehouse, you’ve got records in the database in the Training Manager’s office, and you’ve got records in HR. Who updates them? Your procedures aren’t tight enough. So yeah, we can fix all these, but we’re still not going to get them all in the one system. Two, the operators have no motivation to learn because they can’t see for themselves what they have to do, and Three, It will cut costs – I always throw costs into it – because we’ll be able to deliver consistent training, effectively the same time, every time, and it’s 24 hours a day. He said; “Yeah, that sounds good, now present that to the LST (Leadership Support Team) next week”. I still didn’t win, but I got one stage further forward.*

At this point, Rob’s written case is insufficient, but he has been able to state an effective “verbal” business case to the General Manager, who now agrees with Rob and is prepared to have that case presented to the Leadership Support Team. However, to Rob, things have shifted again. The mention of the Leadership Support Team, as a review and approving body, is new and he still has to rewrite his proposal. Consequently, the approval process is no longer a process that only involves him and the General Manager, leaving Rob with the belief that he has, at least for the moment, lost. It seemed he had convinced the General Manager, but
now he had to convince the Leadership Support Team as well. Of course, it wasn’t quite as simple as making an oral presentation. Rob had to properly prepare his argument which meant formalising all of the research he’d previously done on the business need and Learning Management Systems. As Rob explains, this proved to be something of a challenge:

*I did get a bit of learning out of that. When you want to put a proposal up, always make sure you’ve got some written data just to prove it. I’d checked up on a number of sites. Spoke to the HR people. I did that beforehand anyway, when I was looking at which one to get. It was me who made the blue then. I knew it was a great system and the research proved it was a great system but I was only convincing myself. Once I was convinced, then I was going to go and get it.*

As Rob admitted, he was only convincing himself, which he conceded was a mistake. In hindsight, he knew it was the Leadership Support Team that needed to be convinced. For the General Manager, it was important that Rob be able to demonstrate that the site needed a Learning Management System, and that the cost could be justified. Rob had made a significant shift in his beliefs relating to this process, and he had accepted that he needed to justify the Learning Management System, not just to the General Manager but to the Leadership Support Team as well:

*I had to do it as a project, so I put the project plan up, and we got it, but it could have been a lot quicker. Our systems here at that time weren’t going to change the outcome. The eventual outcome was that we were going to get it [the LMS] but the hoops had to be gone through to prove that it was going to*
work, even though we knew it was going to work, we knew it was going to fly,
but that wasn’t good enough. We had to prove it was going to work, so gut feel
didn’t go for anything.

Although Rob had accepted that he had to comply with the new Capex process, his
remarks about the hoops that had to be gone through indicate that he is still
uncomfortable with the additional, and what he believes to be, unnecessary, layers of
bureaucracy.

This is probably a situation that managers find themselves in more often than they’d care to admit. Rob had assumed, perhaps reasonably, that he was on familiar ground. He’d gone through the Capex process several times before, it was one he understood and was familiar with, only to find that the process had been changed.

When he returned to the General Manager with his revised proposal he believed that he had produced what was wanted, but again found that it was not. Only after being prompted by the General Manager did Rob articulate the key business issues. Which were:

1. WorkSafe’s dissatisfaction with the scattered training records
2. Operator motivation for their learning
3. The reduced cost of operator training and record keeping

Of the three points, the first was significant because at the time, the business was working towards complying with the State Government’s new Major Hazard Facilities regulations and this would have been a particularly sensitive area. The
second was that without an appropriate level of operator motivation any attempt to achieve the required improvements would be futile. And, the third, cost reduction, was another critical argument that Rob needed to make in order to justify spending tens of thousands of dollars on the proposed Learning Management System. Obviously these are the claims the General Manager wanted to hear, and, which gave Rob the confidence to present his business case to the Leadership Support Team. Overall, Rob did learn that if he wanted the business to spend money he needed to be sure his proposal made good business sense.

But why didn’t Rob understand this after his first meeting with the General Manager? In the end it took two attempts and meetings with the General Manager to get Rob to the point where he understood what was required. He still had to write a full business case, and present it to the Leadership Support Team, before he could get approval to buy the Learning Management System. After his second meeting with the General Manager, Rob still had quite a bit of work to do before he would be ready to present his case to the Leadership Support Team.

My claim here is that Rob had been compromised by his existing justified true belief, that is, in the belief that all he was required to do was to complete and submit a Capex, a straightforward request for money. He also believed that the only person he had to convince was the General Manager. The idea that what he wanted to do needed anything other than what he originally did, that is, submit a request for capital expense, was completely justified by his original belief. Consequently when he discovered that the process had become more complex, and that much more needed to be done, he floundered, though only momentarily. He was unable to go
away and write up a case supporting his claim, until the General Manager stepped him through the process.

It is at this point that we also see the fluidity of the propositional and procedural states of knowledge. Initially, Rob is presented with the proposition that a Capex and business case for the Learning Management System is required and both concepts are explained to Rob by his General Manager. These propositions are then proceduralised through the production of the Capex and business case and their presentation to the Leadership Support Team.

In Rob’s case, we can see how our schemata or mental models are constructed by our justified true beliefs and how we can struggle, at least initially, to either assimilate or accommodate new information when it appears to be in conflict with our existing beliefs. According to Choo (1998: 12), as a consequence of our *bounded rationality*, problem solvers ‘satisfice’ by looking for a course of action that is satisfactory, or good enough, rather than an optimal solution. In this case, particularly with his first resubmission, Rob is clearly satisficing, at least according to his interpretation of the need, and it takes him at least one more meeting with his General Manager before he is able to properly accommodate the new Capex process and its additional requirements. For this to happen he had to change his mental models (schemata) of both the Capex process and his role and authority as a Senior Manager. These changes meant that Rob was no longer as independent as he had previously been. Rather than complete a simple Capex pro forma and pass it to the General Manager for approval, he now had to develop a business case, that would fully justify the cost based on its benefit to the business, that would then be scrutinised by a new layer of
management in the form of the Leadership Support Team. In this case we can see how a relatively simple change to a workplace procedure had quite a significant effect on a person and his perception of his place and role in the organisation.
Case 2: A new job for Chris

Chris is a chemist who has recently been promoted from a supervisory position in the company’s quality assurance laboratory to that of Plant Manager. While Chris has had several years of supervisory experience, this is his first opportunity to manage a production plant. This represents a significant transition for Chris. He is moving from a laboratory with a stable, daily routine, from people he knows and with whom he has become familiar, to a production plant, with unfamiliar people, processes and routines. Early in his new role, he finds himself in an uncomfortable situation, as Chris explains:

*It was about 6:00 p.m. early one evening during my first two to four weeks as the Plant Manager, that I had a call at home from the Site Coordinator, to tell me that we had a leaking seal on one of the four blenders. As we had already had the seals changed earlier in the day, it seemed pointless to have maintenance called out to replace the seal again, because I felt we would have ended with the same scenario. So, I went back into the plant to discuss the problem with the shift team, to assess the situation, and work out together, what to do. The people on shift at this time were regarded as hard nuts, and they had a reputation for being difficult and uncooperative.*

Although Chris is new to the role, he has already developed an appreciation for some characteristics of the plant, and its people. His belief that a call-out to effect another seal change would be pointless, and, of course, that the people on this particular shift were regarded as hard nuts had already served to shape his approach to this situation. Consequently, he wasn’t looking forward to what could easily turn into a confrontation.
Here, as with Rob, we are seeing bounded rationality at work. Chris has only limited knowledge of the plant and its people, but this time this knowledge appears to be sufficient to help Chris with his problem.

When he arrived at the plant, Chris met with two of the shift operators to discuss the situation. Chris continues:

> I had a discussion with two of the operators about whether we should be stopping the affected extrusion lines or whether we could damp the seal down with some water to contain the dust and allow the plant to continue to run. In this situation I felt really pressured to make a decision. I felt as if they were testing me out, I was the new guy and they were really testing me out. They were going to put the acid on me, and see which way I jumped. Knowing full well, that whichever way I jumped, they were going to use that as the precedent for how we were going to manage these situations in the future.

Chris believed he was being tested by the operators, and felt under intense pressure to make the right decision. This has become a complex, layered problem, emotionally charged with apprehension and trepidation. On the surface is the relatively straight-forward issue of the leaking seal and how to effectively (and safely) deal with it within company policy guidelines. The underlying layer is the issue of the shift members testing out their new Plant Manager to see how he will react to them and the pressures they apply.

At this point we can see how the bounds of Chris’ rationality, as it relates to this situation, has expanded slightly with the additional knowledge of shift crew’s
reputation and his expectation that they will try to coerce him to make a decision that he doesn’t want to make.

Though the leaking seal and the attitude of the shift team are quite different issues, they are inextricably woven together. Chris continues:

>This shift had developed a reputation. They would be looking for ways to stop the plant, and using relatively minor maintenance issues to do that. They didn’t like running four extruder lines and looked for ways to make the shift a bit cushy, and it was things like leaking blender seals, that they used to shut down lines to give them an easy shift.

It is clear that the members of this shift are trying to see if they can get their new Plant Manager to establish a new, or perhaps, re-establish an existing, precedent. That Chris is aware of this makes it more difficult for the shift to manipulate him into ceding to the sought after precedent. While all this was familiar territory for the operators, having put previous Plant Managers through similar ‘tests,’ to Chris, this was completely new. He had to make a decision, which, he knew, would have consequences for the rest of his tenure in this role. As he explained:

>I had to make a decision, from an inexperienced position, with far reaching consequences. I was two weeks into the job, just getting to know the plant, just getting to know the people, and being thrust under the spotlight and pushed outside of where I felt comfortable.
With his observations of the situation, and what he knew of the team, through his own experiences, and from others in the organisation, Chris decided on a course of action. He outlines his approach and his thinking at the time:

*The consulting process involved some placating, some listening. I tried to put my position, not forcefully, but so that I could hold my ground and not be trampled in the rush. And by the same token not wanting to get into a debate on technical issues because they were always going to have more experience. Whether they were going to argue for the right or wrong reason they were going to be able to say this is what has happened in the past, this is what we’ve done and this is why we’ve done it or its miles too dusty we shouldn’t be doing this.*

Chris needed to keep the blender operating for another twelve or so hours, by convincing the operators that it could safely continue operating with some effective, yet quite minor measures in place. To achieve this Chris needed a consensus. Chris adopted a process that involved listening and acknowledging what was being said, but also, some placating. Chris put his position in a way that would allow him to hold his ground and not be bullied or coerced, and at same time, not wanting to get into a debate on technical issues because the operators, with their extensive plant experience, were going to be able to use this in their favour. They were going to be able to say: this is what has happened in the past, this is what we’ve done and this is why we’ve done it.

During the first few weeks in his new job, Chris had made important observations of the plant and its people, he had acquired knowledge of his own, and from others in
the organisation, about the plant and its equipment, the shift teams and the people in them, the politics of the plant and the people who operated and maintained it. Using this important information, Chris, in the heat of action, was able to act purposefully and make a decision that would be accepted by the operators and set a precedent that he was happy with. As Chris explains:

_In the end a compromise was reached, where I had to give some ground, in that the blenderman and the colour repairers wouldn’t be in the area all the time. The blender would be run and then they would wait for the dust to settle then drop the pre-extrusion blend and check the colour etc. I had to give some time away but this was much better than stopping those lines for the night. Because if I had to do that then that would have become the basis for any future decision and I think that in the past that had been the case._

The sum of Chris’ bounded rationality includes all that he knows about the technical and social aspects of the situation, that is:

1. the seal on the blender is leaking creating a safety problem of high dust concentrations
2. he needs to keep the blender running until day shift, some 12 hours away
3. replacing the seal now is not likely to solve the problem
4. the shift has a reputation for being difficult
5. the shift is using this situation to test him and to force him to create a precedent that is favourable to them
6. he cannot base his argument on technical grounds because the operators are far more experienced than he is
7. His best chance of keeping the blender running all night is through consensus with the operators.

In the end, a satisfactory compromise was reached, in that the shift crew would not be in the blender area all the time. The blender would be run through its cycle and then they would wait for the dust to settle before dropping the pre-extrusion blend and checking the colour etc. This solution sacrificed time, but this was much better than stopping the line for the night. If he had to stop the line, then that would have set a precedent for any future situation. While Chris may have been constrained by limited information, knowledge (justified true belief) and cognitive capacity, it is clear that these limits were not sufficiently limiting to prevent Chris from achieving his goal. In the end, he was able to use what he knew of the situation, the process, the people on shift, and their reputation, to achieve consensus and keep the blender operating overnight.

Dewey’s (1938) emphasis on purpose becomes evident here. Acutely aware of the complexity of the situation Chris needed to stay focussed on keeping all four extrusion lines running overnight which required that the blender remain operational until day shift, establishing a clear purpose. According to Dewey, purpose involves observation, knowledge and judgement. Purposes arise when obstacles to the goal arise. The achievement of purpose removes, or reduces to insignificance, the effect of the obstacle. In this case, the attitude of the shift team members, is addressed, and allows the goal to be achieved. For Chris, there were two obstacles to his goal. The first is the leaking seal on the blender, and the second, and more critical, is the production team’s attitude to this leak. If these impediments had not been eliminated
or mitigated, then it was unlikely that Chris would achieve his goal. But, as we read, by focussing on the more immediate purpose of reaching consensus with the shift team, he was able to successfully translate his purpose into a plan and method of action based on his understanding of the situation and the consequences of his actions.
Case 3: Juan and the ear hook machine

In his early 60s, Juan is a man who brings to his work not only his passion and creativity, but also a wealth of experience. While Juan calls himself a jeweller, on closer inspection, one discovers that he is actually a precision engineer. Over time, Juan has evolved his ability for forming things from metal by using his highly-developed skills to design and build the specialist press tools and machines that are used to produce the findings (jewellery components) that his employees make, and then assemble, to produce his extensive range of jewellery. Juan reflects on earlier thoughts regarding his ear hook machine as follows:

*The story of this particular product and the machine that I am concerned with at the moment is, in fact, an evolving thought that originated twenty years ago when I built a press tool that made wire ear hooks.*

As we can see, Juan first developed the idea for his new ear hook machine twenty years ago when he designed and built a press tool that made gold and sterling silver wire ear hooks. The tool was set in a manually fed and operated press tool that was made in two sections, an upper, moving section, and a lower, stationary section. To make an ear hook, the operator manually fed a piece of hand-straightened wire through a small hole in the lower section of the press. He then activated the press with a foot pedal, forcing the upper section of the tool down onto the lower section, where three cams (pins with a bevelled leading edge) in the upper section made contact, in sequence, with their counterparts in the lower section. First the wire was clamped in place, then, as the cams came into contact, in sequence, with their counterparts on the lower section, the wire was cut and the ear hook was formed through a series of three separate actions. When the press opened again, completing
the cycle, the moving pieces in the lower section resumed their original positions ejecting the finished ear hook.

For Juan, three successive challenges emerged during the design and production of his ear hook machine. The first was to create the perfect ear hook machine, the second, to straighten the wire so it would feed into the machine, and the third, to devise a way of continually feeding wire into the machine. Juan explains the thinking that led to the development of his new machine:

*Coming from twenty years ago to now, the product [the ear hook] had exactly the same configuration with a slight variation in the thickness of wire. A year and a half ago I made another [press] machine with certain improvements, of course, but basically the same concept. To produce the machine that I have produced now, would have required an amount of money that I wasn’t prepared to put into the machine at that time. Also I didn’t consider that there was enough demand for the product to justify building an automatic machine.*

**Challenge 1: Creating a perfect ear hook machine**

Recently, Juan determined that building a pneumatically-operated, automatic machine was justified. This new machine would include a number of improvements and represented a significant shift away from his original press tool design. As Juan explains:

*So then I went back to the original concept that has always been in my mind, even though I’ve added some variations, the concept did not change. Conceptually this particular design is perfect, but I also knew that the greatest*
difficulty presented to me was with the use of cams. The machine operates with six different timing levels and to do that in a press that has only one movement is reasonably complicated, particularly when the timing has to be of utmost importance. Cams don’t give you the flexibility that you will have with an air product due to [the limitations of] the length. You’ve only got 25mm of travel, and those 25mm have to be converted in one instance to 36mm, and in another to 18mm, and in another 9mm. So it was quite obvious to me, that I could simplify the operation tremendously if I used air, because then with a PLC (Programmable Logic Controller), timing would become child’s play. Therefore in the original design [of the new machine], the top part of the die, the part that forces the movement of the punches, was completely eliminated and what I created was a ram that forces the male onto the female without the need for cams.

A photograph of Juan’s new pneumatic, ear hook machine is shown on the next page.
As we can see from his descriptions, Juan’s original press design is quite complex and although his new design is simpler, at least from an engineering perspective, it comes with its own challenges. While Juan had a concept and a sketch, it was still only that. He still needed to convince himself that his ideas could work. Juan explains the process he used to verify his thoughts:

*The evolution of the thought doesn’t really become a practicality until you come to experimentally verify your thought and that can become very expensive. For example: You make a judgement that you are absolutely convinced that something is going to work and then you spend two or three days building a machine only to find it does not work. To solve that problem I created a dummy*
that took simply four hours to produce, that replicated the mechanical movement I wanted to produce with air.

In the extract above, Juan has clearly demonstrated that, at least to him, knowledge must be empirically verified before it has value, with his statement that he must experimentally verify his thoughts. He is also clear in his use of judgement to determine a process of proving the efficacy of his ideas. Here, Juan’s judgement plays a critical role in helping to determine the feasibility of his ‘evolving thoughts’. In his mind he asks the questions: Will this ear hook machine that I am thinking of, actually work? What can I do to test my idea without spending more money than I can afford? His solution is to build a prototype that is simple and quick to make, yet still able to test his idea. These mental processes are also evidence of Juan’s application of Schön’s (1987) reflection-in-action, as he describes the thought processes occurring as he conceptualises, sketches and then, empirically proves his design.

Challenge 2: Wire straightening and feed.

With his new ear hook machine built, Juan’s vision of a simplified and faster machine should have been realised. However, his new machine had brought with it a problem that wasn’t entirely unexpected, but a problem nonetheless. Juan explains that a problem that frustrated him with his old press tool still had to be resolved if he was to realise the full potential of his new machine. Juan explains how this problem affected the press tool he built twenty years ago:

Even though it was a very simple design I learned that the wire needed to be absolutely straight because the tool didn’t tolerate any waving in the wire.
That created a problem in the wire feeding because at the time, it was done by hand and therefore I had to provide a lone device that would keep five or six metres of wire straight. I discovered that it was not just keeping it straight, but keeping it untangled, from the lengths of wire that I would prepare for the operator. You don’t prepare only one wire, if you have to cut three kilos you have to prepare whatever amount of wire is required, not all at once, but perhaps eight or ten pieces of four metres each and as you fed the wires they got tangled and this was a problem, not a major problem, but it was a problem and it stuck in my mind.

I very soon found myself with the predicament that I had twenty years ago. The wire continued to be a perennial problem, an eternal problem, the machine was always operating at 40% of its capacity. Then I thought, okay, I have to manufacture a machine that will free me from operator problems and consequently from an operator altogether, and that thought became very attractive, because I could then free the operator for other duties.

At this point Juan’s reflection-in-action sees the emergence of a solution that immediately becomes very attractive. By designing and building a wire straightening device, not only could he eliminate the problem of having to straighten the wire by hand, he could also eliminate the need to have an operator constantly tend the machine. But he still had problems to solve. Juan explains:

I also found that one of the greatest problems a designer has, at least I have, was to be always conscious that the problem must always be looked at with absolute honesty and acceptance of its constraints. You have to recreate the concept in your brain over and over and over and if you see that there is a little
corner that is giving you a tiny little problem and you pass it over because you consider that it is a tiny little problem, chances are that when you create the tool, that little problem ... has converted itself into something enormously difficult to solve. That is precisely what happened to me with the wire concept.

I knew I was going to encounter this but I thought it wasn’t going to be such a big problem. Well, it was such a big problem, and I knew there was a problem. My fault twenty years ago, and again repeated in a way here, was to underestimate the depth of the problem.

Because of the experience that I already had, I knew I could find myself in very hot water with the ejection of the product. I also knew that the length that I needed to fit (42½mm) was an extremely long length in a wire that is only .75mm in diameter and is soft. Any waving, any curvature or any displacement of that wire, I knew would create problems for me, and I found in the practical verification of that, that I was right. So I was quite prepared for what I was going to encounter, but what you are never prepared for when you design something is the complexity that is presented by the constraints of space. So I was treading very, very carefully, because I knew that I was going to encounter this.

As it happened, the greatest problem was in the wire feeding, so I created a wire feeding device that by rotating, and making the wire pass through a number of holes, while it rotates, straightened the wire to perfection, like an arrow, perfect. But that carried, in itself, a problem that was created by the transfer of this rotation onto the wire and there came a moment in which my logical thought came to a standstill. The motor’s clockwise rotation was creating a problem by forcing the wire away from the ejector plate and preventing the wire from feeding into the machine. I knew that I had to either
revert back to manual feeding or find a motor that would rotate anticlockwise.

Well I didn’t have a choice, I had to find a motor and I found a motor that would rotate anticlockwise and once I did that this complex problem was solved because the anticlockwise rotation of the feeder ensured that the small hook like curve created in the wire was kept in the right place. It did not force itself away from the ejector plate that was designed to keep it in place.

Again we read how Juan is almost constantly engaged in reflecting on his actions as he discovers that all that his new machine promised has been undone with the addition of the wire straightening device, as the clockwise torque placed on the wire, by the spin of the device, forces the wire to turn away from the ejector plate, distorting the shape of the ear hooks.

I was fortunate enough to be present in Juan’s workshop when he first tried this device and encountered this problem. Observing Juan as he worked through his options in his mind, often thinking to himself out loud, it is difficult to see, where exactly his “logical thought came to a standstill”. It must have been only momentary, as he appeared to work though the problem and pronounced his solution in a matter of seconds.

In this example we also experience Juan’s quite rapid application of Dewey’s purpose as he defines his problem and begins formulating a solution through his reflexive practice. Choo’s satisficing is also in evidence as Juan’s thoughts quickly move to the first logical solution, that is, finding a motor with an anti-clockwise rotation. If you examine the photograph, below, which shows the wire-straightening device and its motor, in operation, you might be able to see that twisting the rubber
drive belt into a figure eight, would reverse the rotation of the wire-straightening device. Juan’s satisficing is also influenced by his bounded rationality which limits the options available to him. If he had known how twisting the drive belt would have solved his problem, we should expect that this would have been the first solution to emerge and be quickly adopted.

Figure 5: Wire straightening and feed
Challenge 3: Wire feed drum

However, even with the problem with the rotation of the wire-straightening machine, solved, Juan still had one challenge to overcome. As he explains:

> Now, the other practical problem that I had to confront was how to create a device that would allow the rotation of 1kg of wire with virtually no friction. That is totally friction free, in other words if I blew on it, it would rotate. But it would rotate in two directions, the wire clockwise and the coil itself, anticlockwise. I had to create something similar to a fishing reel but it had to be a lot freer. I solved the problem by creating a device with two ball bearings that play within each other, one in a set position and the other in a rotary position, one for weight and one for rotation. Once I did this, and found that it worked, the rest was quite logical. I simply had to create a mast that the coil would fly around and once I did that the feeding of the wire was solved.

As Juan solves first one problem and then another, moving from a single device, to two, then three, we are able to see not only how the solving of one problem led to another, but how the solving of that problem served to clarify the next. Making it possible for Juan to firstly, define his problem, and then to solve it.

Initially, Juan’s motivation was to simply build a new, and better, ear hook machine that would allow him to eliminate the things that most frustrated him about the existing mechanical press tool, which were:

1. the change-over and set-up time for the press tool
2. the need to manually cut and straighten the wire
3. the need to manually feed the wire into the machine, and therefore a need for a person to operate the machine exclusive of other activities.

To advance from concept to the concrete, Juan first had to make sense of exactly what it was he wanted to achieve. Initially there was a high degree of ambiguity in his quest for the “perfect” ear hook machine. Many hours were spent visualizing the new machine as each component moved to shape its part of the ear hook. As Juan explains:

To work this all out, I first have to have my ideas materialise in my brain. I learned this long ago. I discovered that I had a great ability to design, and to physically make things work, three-dimensionally in my brain, very much like
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the 3D computer programs that we see today. That is the only way a designer can see things functioning. It’s just a process of evolving, travelling within the device that you are creating, and with the design coming to fruition in your brain.

Only when he felt he had “imagineered” all of the problems out of his machine did he begin the physical task of proving his idea. And this was done with a simple prototype that proved pneumatics could replace the mechanical operation of the existing press machine.

In his mind, Juan had a very clear picture of his new machine and how it would work, but there were emerging problems that he did not envision, or anticipate, only discovering them when he literally came face-to-face with them.

Through the use of his imagination, Juan is creating the prototypes of his machines in his head, visualising the machine, its parts and their operation, then asking: What is happening? Why is it happening? And, what comes next (Beckett and Hager 2002: 23)? Juan’s ‘imagineering’ could easily be construed as Cartesian. His mind does seem to be operating separately from, and governing, his body. But his thoughts are reflexive; there is clearly an intention to act in an anticipative, forward-looking and creative way. Juan’s thoughts are feeding forward, rehearsing the accomplishments that he eventually achieves by initially trying out his concepts in his head, before applying them practically in his workshop. (Beckett and Hager 2002: 36).
Using this process Juan was able to solve many of the problems that might have otherwise prevented him from bringing his pneumatic ear hook machine into being and, as we have seen, this process continued throughout the development of his machine.

All through his endeavour Juan is acquiring and applying know-how. Know-how is exercised when people intend to make a difference in what they are doing at work and in their lives in general (Beckett & Hager 2002: 39). But, more importantly, he is developing the know-how he needs to build a fully automatic ear hook machine. This is know-how that he only realises he needs as the process of creation develops and new challenges emerge. This is something he has never done before. What he was experienced in, and what he did know how to do, was to design and build press tools. Using this limited and somewhat vaguely-related knowledge, he embarked on a journey of discovery, one that led him on a path of learning, sometimes with quite unexpected results. Though Juan had never built a machine like this before he was nevertheless sure he could do it. And he did!

What we can also see as Juan moves from his initial concept through to the completed ear hook machine is purpose. Juan is purposefully moving towards his goal by identifying, clarifying and solving problems that must be solved if he is to be able to go on. If his pneumatic machine had not worked, he would not have needed a wire-straightening device, and if his wire-straightening device had not worked, he would not have moved onto develop his wire feed device, and Juan would not have a fully automatic ear hook machine, his original goal.
What is also of interest, is the total lack of social engagement involved in Juan’s endeaver. This has been a venture involving only Juan, his ideas, his work environment, and all of its artefacts. At no time, did he engage with anyone about the design, construction, or the problems encountered. However, what is also evident is the critical role that Juan’s life history (his biography) has played in the success of this project. As Juan explained, this was the culmination of over twenty years of working with jewellery-making. In this context, bounded rationality takes us beyond the limitations experienced first by Rob and then by Chris in the earlier two cases, above. Juan’s rationality, though bounded, is far more expansive that that of either Rob or Chris, allowing him to draw on a wealth of experiences that provide him with solutions in a relatively short time.

Juan’s completed ear hook machine, showing all three components, in action, is shown in figure 7, on the next page.
Figure 7: The ear hook machine in action
Case 4: Phil and 3½ minutes to knife

Phil is a chemist who, at the time of this interview, worked as a production manager on a plasterboard manufacturing plant in Melbourne. Shortly after joining the company, and still in his role as chemist, Phil was given the task of reducing the plasterboard manufacturing process from eight, to three and a half minutes. Although this time had been achieved by other plasterboard companies, it hadn’t been done in any plant belonging to the company that Phil worked for, and they didn’t know how to do it. Working out how was Phil’s job. So what do you do, when you’ve been given a task that, at least for Phil and the company he worked for, has no known solution? Phil puts this question into perspective for us below:

When I first joined this organisation there was a company set-up to build the plasterboard business throughout South East Asia. At that stage the plan was to build up to five plasterboard plants throughout the region. I got heavily involved in all of those, but in particular, one in China, and another in Indonesia, and consequently spent some time in China. At that stage I was a Product Development Team Manager and we were given questions related to the specifications of the plant design and capability, for example:

- Could we use this type of calcination equipment to make our plaster?
- If so, what are the good and bad points about that?
- Could we run the line such that it was 3½ minutes from mixing to knife?

All very nice questions, but the problem I was immediately confronted with was: how the hell do I know?
How the hell do I know? This is Phil’s very clear expression of his feeling of disequilibrium. Piaget (1976: 111-2) and Von Krogh et al. (2000a: 19-20), tell us that when we experience disequilibrium we attempt to overcome it through a processes of assimilation and accommodation. This is exactly what Phil sets out to do.

Through a process of assimilation Phil reconciles his task of developing a process that can achieve a ‘3½ minute to knife’ with what he already knows about the process at his board plant. Realising that an explicit, and detailed, understanding of their process did not exist, Phil, and his team, first set about learning all that they could about the existing plasterboard-making process. As Phil explains:

Well that was the very first question I asked. How do I do this? And no one came to me with a book of instructions. No one had ever done it before, they had sort of built plants that were pretty much clones of one another because, we know how that one works, so let’s build one the same. This one’s calcination technique and its gypsum source were quite different so everyone was a little bit more nervous.

I had to convince myself first, before I could convince anyone else that it was possible. I admit I was a little nervous when they first said that we’ve got to have a 3½ minute time to knife. I said, well how do we measure that? Given that you’ve got different process conditions, different plaster in particular. We really had no way of predicting that in the beginning?
As it turns out, Phil’s challenge is more than simply developing a process that could deliver a 3½ minute time to knife, but to develop a process with a 3½ minute time to knife, using a new, synthetic raw material. This would be the company’s first plant with a 3½ minute to knife, and, the first to use synthetic gypsum. However, as Phil explains:

*There’s no text book on this stuff, and no way of predicting it theoretically, you have to go and work out ways to experimentally verify that you can actually achieve these targets.*

These are some of the very issues Juan discusses. Although not a scientist, Juan realises the importance of experimentally verifying, that is, practically verifying, on a small scale, his ideas. Any new learning that comes from this approach involves an accommodation process. It is clear that both Juan and Phil are creating new knowledge from their experiences. And like Juan, Phil also realises how easy it is to underestimate the consequences of what you do, or sometimes, what you do not do. Phil explains that:

*I’m a person who needs to understand. We went back to the basics of how this plant ran and I tried to get some understanding of what was important. Why did this place work? Once I understood why this place worked, I could then say, okay, these are the things I need to make any plasterboard plant work. So therefore, we then went to mimic all of those things in the lab, and when we got a match to all of those parameters with this plant, I then started to change a few things to see if we could still achieve all of those parameters, but with a shorter set time.*
As often happens, when you change one thing you affect three and this is where I think a lot of people make a mistake, they change one thing expecting one thing to happen. You’ll change three, because, you haven’t got the understanding, that if I change this, I also need to change that, to still make it work in the same way.

Phil didn’t stumble on this cascade, or knock-on effect, caused by changing plant conditions, as unexpected consequences of his experiments. He anticipated (Beckett and Hager 2002: 34-7), that anything he changed could have such an effect. When asked if he knew in advance, that if he changed something in the process, he would have to compensate somewhere else, he responded:

*Or that I may have to, and we’ve done that by running our lab experiments versus the conditions we run on our plant. So we then said, okay, here are the normal conditions that we run on our plant, here are our lab conditions that run the same way, what happens when I do this?*

Phil’s judgement, or practical wisdom, (Beckett & Hager 2002: 37) in anticipating that the changes he and his team make at one point in the process, could have consequences further down the line, would have saved the team, and the company, a considerable amount of time and money. Making practical judgements, such as these, may appear to be simple, and in hindsight, obvious. Common sense, one might think? But I suggest that oversights, or failures to recognise these types of effect, are probably just as common. In my own work I have witnessed an experienced engineer fail to anticipate, and make allowances for, something as simple, and straight forward, as the expansion effect that a hot process flow would
have on a cold mild steel pipe. The consequences of this failure, was that as the heat was suddenly introduced the pipe-work distorted significantly, twisting along its mountings, nearly ripping the pipe from its mountings and almost undoing two weeks work in just a few moments. So the risks are high. Phil continues:

_We started off by understanding what the time to knife here was. What the setting characteristics were. What controlled those setting characteristics, and what variables we had to play with to reduce that time. We typically run between six and eight minutes to knife, so we were looking for about half what our time was here. We basically began by understanding what happens on this site, understanding what variables we had. The next step was that we developed laboratory scale tests or procedures to mimic that, and once we were confident that we could mimic a change in our own plant, and mimic those changes in our test procedures, we were happy then, to explore and to see what we could do to achieve even shorter set-times._

_This involved us learning how to mix properly in the lab. The procedures that were around really bore no resemblance to real life. We had to learn how to make some of the additives additions. When they’re added makes a difference, and it took us some time to develop those techniques to a level where we could confidently predict a change here, and therefore, felt confident, that we could predict a change on a faster plant. We then had to complete a fairly extensive test program, and write it all up to confirm that it was, in fact, possible. Based on our work, they built the plant with a 3½ minute time to knife._

There is also considerable risk for both the company, and Phil, in this project. Phil had his professional reputation and perhaps his career at risk, while the company had
millions of dollars at risk. When Phil had been assigned this task, the company had already purchased the land on which they were going to build the plasterboard plant. If 3½ minutes to knife couldn’t be achieved, the company would have had to rethink its whole China plan. Phil explains that:

If we had stuffed up and said you could run a plant to 3½ minutes, and in fact, you couldn’t, it would have involved huge expense. They would have had to literally extend the building, literally extend the line.

The distance of that line was about 200 metres long. You’re looking at adding an extra 100 to 150 metres to the length of the line, and building, and everything that goes along with it. We didn’t own the land to do that. We would have had to buy extra land. It may have, in fact, influenced the location.

Phil is an experienced research scientist, with several years working at the CSIRO. Using computer models and laboratory experiments are second nature to him. When assigned this task, one of the first decisions he had to make was, what would be the best method to, first, develop an understanding of the new process, and then to test it? He could choose from three options, a computer model, laboratory research or practical plant-based research. In the end, though, Phil decided that a computer model wasn’t viable and the best approach would be to focus his attention on the plant, supported by some lab work because:

In my previous job we were working on three-dimensional computer models using Cray computers and things like that, and I know what they can do, and can’t do. There’s just no way that there’s the time and money available, or that
it’s warranted to do that sort of thing for the plasterboard industry. You have
to get out there and you have to do it.

If you try to [computer] model it you’ve got to do the work anyway to verify
your model so you’re paying for a model which you’ll use once or twice in your
working career probably. It’s just not worth it when at the end of the day
people wanted to see that we had paper bond, people wanted to see that we
could get it to set in 3½ minutes.

A practical workplace solution was the only acceptable outcome that this project
could have delivered. Whatever Phil and his team had learned about the plasterboard
process, a 3½ minute time to knife had to be the outcome. While a 3½ minute time
to knife might appear to be a relatively simple objective, at least to an outsider, this
reduced time to knife also had to produce a plasterboard product that met important
quality criteria, such as board strength. As Phil explains:

It’s not a case of just getting the setting time. We had to achieve a good paper
bond and a whole host of criteria that we had to meet and it wasn’t easy to do
that.

Plasterboard consists of a thick layer of plaster sandwiched between two heavy paper
sheets. As the bulk of a board’s strength comes from the paper, the bond between
the plaster and paper is critical. If you fail to get a complete bond, the plasterboard
is too weak, and the paper will separate from the plaster. One of Phil’s greatest
concerns was that a ‘3½ minute to knife’ would fail to produce that critical bond.
Phil explains that:
If I went out into the plant here at the moment and I played around with some of the setting parameters, I could stop the bond, and even though the plaster core would set hard, the paper would just peel away. So you have to make sure you understand all of the requirements, and make sure you’re still achieving those, even though you are changing some of the other parameters.

In plasterboard, paper actually provides you with up to 90% of your strength. So, of course, if you’re not going to bond the plaster to the paper, you’re in trouble, aren’t you? So, you had to take several steps back, go back to the basics, and develop a process from there.

But when you get to a point where you are confronted with a number of different options, what do you do? Is it all trial and error, or do you make judgements based on your knowledge that lead you through a process? And when it comes to testing your laboratory findings out on the plant, do you just go and do it or is this a negotiated process? How do you persuade the people who are responsible for production, people you do not actually have any authority over, that they should allow you to experiment on their plant? For Phil:

That was a matter of demonstrating what we’d done. Saying we understand the risks, and running these changes for only a few minutes, to minimise the impact on people. And clearly things that were going to put the plant at risk, or people at risk, we just didn’t do. We accepted that we couldn’t do that on the plant. The things we did, we could vary the setting times, we could play little games out there quite easily, just to verify what we’d done in the lab, and once we’d gotten a certain distance down the track, we then said, okay, let’s switch over to the plaster that was going to be used in China and learn about that plaster,
because it was very different, and came from a synthetic gypsum source rather than a natural gypsum source. So that was one change we made, we left everything else as it was.

After proving that his lab work had developed the right operating conditions to produce a ‘3½ minute to knife’ process, the final thing that Phil and his team needed to do was run the plasterboard plant using synthetic gypsum. This was a critical, and final step, in proving the new process, and the only way to do it was run the existing plant on the gypsum that was to be used in China. As Phil explains:

We actually got plaster made by the company who were going to supply the calcine equipment in Germany. They sent us back a hundred kilos, and we played with that to understand it, because it had some fairly unique properties because of its particle shape. So, based on the knowledge that we had on our own system, we then started to disturb it, if you like, by firstly putting the new plaster in and understanding what that change did. Then we started to play games using a set of new baseline conditions to see what we could and couldn’t do, and ultimately to shorten our time down to 3½ minutes, and it worked, and worked well.

Phil just didn’t create a new process, and the knowledge of how to do it, and leave it at that. He, and his team, made sure that what they had learned was properly recorded, and available, if anyone should need to repeat what they did. Photographs, photocopies and reports were created and filed so that they could be used again:
We were able to photograph and photocopy our test pieces as a means of storing information, and you could see that you had achieved paper bond at certain times, and things like that. In terms of anyone in this company knowing how to do it when I first arrived, they just didn’t. Funnily enough, in talking to people since then, as I’ve got to know more and more people throughout the company, there’s little snippets every now and then, when people say, oh yeah, that’s right, we knew that, we knew this. It pulled together a lot of knowledge that was in certain individual’s heads but wasn’t ever collected together.

We looked at at least five plants, and did similar type studies, but having the basic understanding of what was going on, it was easy. It didn’t frighten me, it didn’t frighten us at all, because we understood what was going on, we understood what variables were important, what outcomes were important, what variables we had to play with. Could we do it or not? Effectively put it into our physical model, if you like, and give it a go.

In the end, Phil and his team not only worked out how to design a plant with a ‘3½ minute to knife’, but created, collected, and made available, a wealth of essential process knowledge that was previously either unknown or scattered through the company, literally, in the heads of individuals.

As with Juan, Dewey’s (1938) purpose is evident in Phil’s work. As he developed his understanding of the company’s objectives and what he and his small team needed to do to achieve it, purpose served to provide focus on the “stepping stone” outcomes that had to be achieved if the goal of 3 ½ minutes to knife was to become a reality. As Phil explains, 3 ½ minutes to knife was far more complex than it sounded.
As Phil reflects on his goal and how to achieve it, he puts together a plan of action that involves finding out all that is known (internally) about the plasterboard manufacturing process, observing the process and making judgements about what to do next. This process led him to the development of experiments which would help him to prove, on a very small scale, what he hoped to achieve on a full scale plant, before going ahead with a full scale trial. Again we see that this second process involved the same steps of collecting knowledge, observations and making judgements, that enable Phil to eventually prove that 3 ½ minutes to knife was achievable with the plant and equipment that the company already had in use.
In our second encounter with Rob, we find him seconded to a production plant, temporarily replacing the Plant Manager, who unexpectedly resigned during a routine, but complex, start-up operation after the plant’s regular planned maintenance event (PME). As the Plant Manager, Rob is responsible for ensuring the safe and efficient, return to operation of an integrated petrochemical facility that will take between four and six days to start-up from cold. During the PME, significant maintenance work has been done on the plant’s vessels, equipment and instrumentation. We re-join Rob as he deals with a problem involving instrument settings on one of the plant’s compressors, a critical piece of equipment that must be put into service, if the rest of the facility is to return to production. As Rob explains:

The propylene compressor, which is a high speed turbine driven, multistage centrifugal compressor, and very expensive, was having problems. It had tripped on a high temperature on an outboard bearing. So we put it on danger defeat, which is a system that allows the operators to manually defeat the automatic trip system if they know that the problem is either spurious, or not a serious problem. So we started it up again and then rang the engineers to come over and fix it. The operator had a look at the trip set point and it was set at 88°C. This meant that the compressor was never going to work, because in summer [and it was summer], that bearing would run at 97°C, so the operator called over the Instrument Technician who had set it up, and said that he was going to have to change the set-point. He [the technician] said; “No, I’ve put all the settings in directly from the manual, I can’t do what you’re asking.” The operator then talked to the Engineer, the Engineer talked to the Instrument Technician, and the three talked together. And no decision was made! That’s when the operator rang me, and I came over to see what was happening.
When the situation was explained I said; “Ok, what was there before? What is there now? And what are you going to do?” The Engineer’s recommendation was that the set point would have to stay on what it had been set at, because that’s what the Instrument Technician got out of the book.

The book in question is a complete set of instrumentation settings for the plant. Over several years of operation, the settings on many of the instruments had been modified to reflect local operating conditions. All of these changes had been made by technicians with the approval of both engineering and plant management, and the new settings should have been recorded in the book that the technician was referring to. Rob explains that:

We had made changes throughout the years, and other books had been filled in, but they had taken their information from a wrong area. It was entirely safe, what they [the instrument technicians] did, but it meant that we couldn’t run the plant unless we ran it on danger defeat. The recommendation that came from the Engineer was to run it on danger defeat. Now danger defeat not only defeats high temperature trips, it also defeats any vibration trip, and if you defeat a vibration trip you can do some very severe damage to the equipment. We’re talking millions of dollars in damage. The operator wasn’t keen on that, and when I heard about it, I was absolutely against it, and said: “No! We can’t put it on danger defeat.” So they were arguing and I said; “One of you make a decision.” They wouldn’t make a decision. I said: “Right! I’m making a decision! Put it up to 97°C and we’ll take it from there, because I’m not running it on danger defeat and I’m not shutting the plant down.”
The situation is getting tense, and emotions are running high. Both parties, operations, and maintenance, have quite legitimate grounds on which they are basing their arguments. For the maintenance people, it is the requirement to set instruments according to the information provided in the ‘book’. For operations, it is the imperative, to have the plant running – delays in getting the compressor running are costing thousands of dollars every hour.

To resolve the deadlock, Rob, as Plant Manager, has to act. His decision, to instruct the instrument technician to change the set-point, is clearly practical. The compressor cannot run on the lower set-point, so Rob, with his years of plant operating experience, and knowing that the information the technician has used is wrong, has instructed the technician to set the temperature trip to 97°C. But Rob didn’t get the response he expected:

_The engineers conferred with each other. They weren’t too happy about it and said; “We can’t do that, you’ll have to put in an MOC.”_ An MOC is a Management of Change procedure, which means you have to look at what the change is going to be, then you have to go through and do a job safety analysis on the change, and what it will impact, and what the outcome is, if it goes wrong. It’s quite a lengthy process.

_When they said that, my little mind went “PING!” I said: “Guys, put it back to ninety seven, that’s where it was, that’s where it’s been and that’s where it’ll stay. You had no authority to change it. I’m not doing an MOC, but if you want to change it to eighty eight, you do an MOC because that’s the change. It was set at ninety seven before you altered it; therefore, you have to put it back_
to what it was. Check the records and you’ll see that it’s been running between eighty eight and ninety four for years. If you want to put it to where you want to put it, you do an MOC and we’ll look at it, otherwise, just get on with it. Then I walked out and left them. They checked the records, saw that it had been running above eighty eight and they reset it at ninety seven.

In this passage, we see an example of thinking in action, where Rob’s description of his mind going “PING” and providing him with a sudden and effective solution, which he immediately implements, is an example of what Beckett and Hager call reflection in hot action.

By suggesting that Rob put in an MOC, the engineer had suddenly given Rob the information he needed to get the compressor running. Perhaps all three could have argued in circles, all day, without a resolution, but the mention of the MOC provided an answer to the question: What do I do next, in order to move forward? Confronted with this, Rob immediately turned the question back on the engineer, claiming that what the engineer wanted to do required the Management of Change process, and directed him to the plant records that would prove his point. These records are quick to find and examine, and the engineer, just as quickly agreed to ‘return’ the set-point to its previous (and correct) setting. What is of interest, in this example, is that it is the engineer who inadvertently gives Rob the clue, or cue, as to what to do to get the set-point problem resolved quickly. By suggesting the MOC, the engineer has triggered in Rob, a memory of the MOC process that he used to his advantage, much to the surprise of the engineer. In this account of Rob’s thinking there is no suggestion here of a Cartesian ‘head-over-hands’ underpinning explanation. Rob, in particular, is thinking and acting concurrently, he is not thinking then doing. He is
making sound, practical decisions, in hot action; he is, we might say, ‘feeling the heat’. And, you can be quite certain, that if Rob ever found himself in a similar position, it would be him citing the MOC process, as a means of resolving what has the potential to be, a stand-off situation.

All with both parties to the situation were frustrated by conflicting pressures, that is, by the need to get the compressor running and complete the plant start-up, and by the need to ensure that the trip-points on the compressor are correctly set. If we were observing this, we would notice a lot of hand and arm gestures, facial expressions, body language and finger pointing. This is not an example of a mind, separated from a body, thinking, but of whole persons, in the world, acting to achieve their purposes.

In this next case, Case 6, we stay with Rob but his workplace context has changed as we see his responsibilities and goals change, from plant operations and start-up, to plant maintenance and budgets.
Case 6: Rob and the plant turnaround

Turnarounds, quite commonplace in the oil and petrochemical industries, are mandatory large-scale planned maintenance events (PMEs) that occur every three to four years. Plants are shut down so that inspections and work that can only be done with the plant shut down such as catalyst changes, instrument maintenance, internal pipe and vessel cleaning and repairs, can be done safely. Turnarounds are intensive periods of work and usually the exclusive domain of the production and maintenance departments and, until this particular event, had always been managed by an engineer.

At the time of this particular turnaround, Rob was the Training Manager and worked in the Human Resources Department. Just a few weeks out from the scheduled start the assigned turnaround manager suddenly resigned, recommending Rob as his replacement. While Rob had no engineering qualifications or project management experience of this type, or magnitude, he had obviously impressed the right people because he was offered the position, and while reluctant, he decided to take it on.

Rob explains the circumstances of his move to Turnaround Manager:

I was a bit stunned when the HR Director asked me, and I said “I’m not an engineer” and he said “we don’t want you to be an engineer, we want you to run the turnaround, you’ll have engineers working for you”. I said, “Oh well, can I think about it?” And he said: “Yeah, you can think about it.” Which really meant: you can think about it but we’re going to put you there anyway. So I thought about it and next day I said, “Oh well, fair enough. I’ll give it my best shot” and went across to the plant to work with the guy who was leaving.
This has put Rob in a difficult position as he’s taken the “request” to be a directive, something he cannot say no to. While to many, this might seem like a rather straightforward problem, Rob’s ‘judgement’ here is crucial. By accepting the challenge he has made a significant role change, into that which he has no previous experience. By taking on the responsibility of running the turnaround the credibility of the whole site is being put on the line.

The perceived issue for Rob is not simply to do or not do the job of Turnaround Manager, but perhaps, how he will be perceived by the organisation’s senior management. If he refused and the turnaround failed to meet target, then he could be seen as letting the side down. But by accepting and managing a turnaround that still failed to meet target, he would still have let the side down. This would seem a no win situation, where the safest option would have been to decline the request.

With only two weeks before the start of the turnaround Rob officially took on the Turnaround Manager’s role and began shadowing the outgoing manager. However the transition wasn’t what Rob had expected. As he explains:

> The outgoing turnaround manager was quite happy because he was leaving and looking forward to his new job so he said to me, “There’s the [turnaround planning and information] folders, have a look through these, I’ll be back.” And he did a round of lunches and all the various things that you do when you’ve only got two weeks to go and in those two weeks, probably only spent eight or ten hours with me. So I wasn’t briefed exceedingly well on what was required. So I did a fair bit of reading and went to a couple of turnaround meetings, with this guy and then he was off.
The previous turnaround had not run as smoothly as it should, suffering a few mishaps including running over time and over budget by quite a large sum of money. Senior people in the US-based parent company were disappointed in this poor outcome and, as previous turnarounds had similarly poor outcomes, this turnaround was seen by many as this site’s last chance of managing a major plant turnaround. In fact, as Rob said:

As a result of the last turnaround one of the processing units was down an additional three months because people couldn’t make their minds up whether to replace or repair key components. If we didn’t do it right this time they (the parent company) would send their people in to run turnarounds and we would be cut out.

Rob’s first task as Turnaround Manager was to chair the turnaround planning meeting. With the information he’d received during hand-over, including what he’d learned through his extensive reading, Rob walked into his first Turnaround Meeting as its manager, and as he explains:

I walked in there and I started to run my first meeting and of course there were a few engineers there who were a little bit cut-up because they probably wanted the job, though I don’t know why. And one of them threw a Dorothy-Dixer at me, which was quite difficult and something I hadn’t thought about, and my response could have really impacted on how well I was going to run the turnaround from then on. So I had to make a quick decision and what I did was hand the issue straight back to the engineer who had raised it and said; “Good question Al, why don’t you look after that area for me and give us a report every
week? I’m not quite up to speed there yet, but I’m sure you are.” And then we moved on. Well that guy never interjected again in a meeting and he did a bloody good job of what I asked him to do.

This is an example of Beckett and Hager’s ‘hot action’ and is clearly a point in time when judgement played a critical part. Chairing his first turnaround meeting, Rob was not feeling confident that he knew what was going on, and was soon confronted by a question on an issue he knew nothing about. His credibility as the Turnaround Manager was on the line. However, by handing the issue straight back to the enquirer he reaffirmed that his role was to manage rather than take or attempt to take a “technical” role in the project. In effect, he had let the engineers know that, while he still needed to control certain critical aspects of the project, he wasn’t going to attempt to interfere with the technical aspects of the project engineers’ jobs.

Over time the project management culture in the company where Rob worked had seen budgets become just a set of figures that were developed because you had to. They were often set deliberately low, just to get through the red tape of the approval process, then once approved the project engineer would spend what was needed to get the job done. This is not a particularly smart way to do things but it had become the way things were done around here. As Rob explains:

*We were about four months away from mechanical day one and I was looking at what needed to be done. So I got the spread sheets printed out with all of the jobs which had been scheduled to be done during the turnaround. Now, its got to be understood, that during a turnaround you only do jobs that cannot be done at any other time. Jobs that need to have the plant shut down so you can do*
them. Turnarounds are an opportunity to shut the plant down and do those jobs and only those jobs. If we could do it during a normal regeneration\(^1\) or something, we would do it then. The cost of the mechanical side of a turnaround is at a premium because you’ve got heaps of guys in, you’re paying high money for it, they’re working overtime, you’re running shifts etc., days and nights, and you pay a lot more than getting regular maintenance done through your own company. So I’ve gone through the spread-sheets and the first thing I did was to break them up into areas that the engineers were responsible for. I hadn’t done this before. It was just an idea that suddenly popped into my head, so I thought I’ll try that and see what happens.

This is another example of Dewey’s (1938) ‘evolutionary’ purpose, when, not having managed a turnaround before, and looking for what to do next, as a means of moving forward, Rob has decided that framing a thorough understanding of what was scheduled, who was responsible for it, and how much it would cost, was a good place to start. Then, looking for a way to move forward and, to simultaneously, understand the work, and the budget, and how to manage it more effectively, Rob decided that it should be the responsibility of each engineer to account, not only for the work in their specialist areas, but their budgets as well. Given this organisation’s history with turnaround budgets, the assignment of accountabilities may be just the thing to do, to bring about the needed improvement in turnaround performance. Rob explains that:

\[
\text{I divided all the work into all the different engineer’s areas and I sent each one their part of the spread-sheet and asked them to go through and take out all of}
\]

\(^1\) A regeneration (catalyst regeneration) is regular maintenance event in one section of the plant.
the jobs that don’t need to be done during the shutdown and I said; “do it and you’ve got two days!” Of course two days later I get the results back from them and they’ve taken 3/5 of nothing out. There are still too many jobs on the list. So then I thought; ‘that didn’t work very well that way, what else can I do?’ So I sent another memo back out to the guys and we discuss it at the meeting and I gave it to them in writing as well and I said; “look we have six million dollars to spend and out of that six million I want to keep back six hundred thousand for contingencies, for things that we haven’t planned for that could go wrong and already you’ve spent six and a half million. I said; “you’ve got to take some stuff out.” They said; “we need to do it.” And I said; “Well, we haven’t got the money to do it.” Their response was that we need to do it, you’ve got to do it, it’s there it needs to be done. I said; “Guys, I need a new fridge, I need a new car, I need a new TV. I’ve got enough to buy two. I sit down, I analyse and I work out which one can I put off until next year and I buy the other two. I don’t buy the three because I can’t get a loan. No one will give me a loan because I’m a bad risk, and we’re the same, so we’re not doing that. Which didn’t work very well again, so I thought; “Ok, they’re not going to do it themselves, what I can do?” So I got the spread-sheets and I went through them. I knew I had to save about $350,000 off each area. So I went through the jobs and I selected three, just randomly, that added up to about $340,000 to $350,000 and I scored them out. I did the same with each of the engineers and I sent the spread-sheets back to them by email.

Still driven by an evolving sense of purpose, these further actions occur amidst “hot action” and “practical judgement”. With this latest tactic, Rob did not intend that his cuts would be either real, or permanent. They were simply done to force the engineers to make their own ‘judgements’ about what could be removed from their
lists. A risky move: would his engineers rethink their job schedules or would they revolt? Rob explains that:

"Probably about two seconds after it landed on their desks I had phone calls from each of them. "You can't do that!" I said; "Yes I can, I'm the Turnaround Manager, I can do whatever I like. They were a little bit upset, "who's this upstart telling us what to do!" "Bloody ex operator, blah, blah, blah." They tried to bluff me. It didn't work. They rang the General Manager and he said; "Rob's the Turnaround Manager, don't ring me, ring him." So I had good support.

Support from the General Manager was crucial. Had he sided with the engineers, Rob's whole strategy would have collapsed and his credibility ruined. The story continues:

"So finally when they'd calmed down, I said to them; "Look guys, I don't know what I'm taking out. I'm not an engineer, you are. I asked you to take stuff out, you wouldn't do it. I've got certain targets I have to meet and one of them is to meet budget and with what you had in, I can't meet budget, so I've taken them out. Either you go through your lists properly and work out what you think we don't need to do, and as long as it's not unsafe, take it out." And eventually that tactic worked and it worked pretty well.

Rob has actually employed a high-risk strategy that might have just as easily failed. There are points in this story where Rob has pursued his purposes and exercised "practical judgement" in quite a graduated way, so that he can achieve the goal of
having the engineers take responsibility for the work and budgets in their own areas of expertise. He has identified a preferred outcome, and tried ways of moving the engineers from their present mindset (of being specialists with no budgetary responsibility) to a new mindset where budgetary responsibility is acknowledged and accepted. This may also have some effect on ‘normal’ operations as these same engineers have routinely allocated non-turnaround work to turnarounds to avoid scheduling and other operations versus maintenance issues.

In taking on the role of Turnaround Manager Rob was in new territory. While he had no previous turnaround management experience, and was not an engineer, senior management had identified a capability that Rob himself had not: the ability to think on his feet, to solve problems and to keep the various parties (engineers) engaged and on-side. While Rob had worked in an operations role during several previous Turnarounds, it was mostly to do with preparing the plant and equipment so that the maintenance work could be done safely. With no understanding of how to do the job of Project Manager, but with a couple of clear objectives, Rob managed to do what no other project manager had done previously, that is bring the project in on time, and on budget.

As well as demonstrating the effective emergence and refinement of purpose, practical judgement and hot action, this case has exposed the negative side of communities of practice. As a non-engineer, Rob initially experienced significant difficulty being accepted as a legitimate Turnaround Manager because of his non-engineering background and his previous role in training and human resources in this organisation. Consequently he was not accepted as readily by the turnaround
engineers, who were already a close-knit community, and while Rob was well-known to them all, it was as the Employee Development Manager, not as an engineer. While not allowing him into their community as such, they did eventually acknowledge his authority, but only after some tense and potentially damaging confrontations.

There are several instances where Rob has shown a capacity to use ‘practical judgement’ when confronted with a problem that would have prevented him from achieving his goals. He has been able, in each instance, to not only remove these barriers, but, more importantly, to change a culture from one where budgets were seen as an annoyance, something to be gotten around, to one where budget targets became an acknowledged and legitimate purpose that all project engineers were responsible for, in their more ‘granulated’ decision-making.

There is also clear evidence of Choo’s (1998) satisficing. As Rob learns more about the turnaround, a solution to his over-budget issue emerges in the form of the tactic that initially saw Rob sort the planned work by engineer, then ask each of them to take the work out of the schedule, finally removing a number of work items himself. This granulation saw enough unnecessary work removed from the schedule to enable the Turnaround to be brought in on budget.
Case 7: Jo and a challenge of change

In this case we meet Jo, an Occupational Health and Safety Systems Specialist, with a multinational manufacturer. Trained as a nurse, Jo joined the company several years previously as the Occupational Health Nurse. After undertaking postgraduate studies in Occupational Health and Safety, Jo recently moved into a specialist OH&S role. While this has been a goal that Jo had been pursuing for several years, it also represented a significant career change. Jo had changed from being an experienced and expert medical specialist to an inexperienced, novice safety specialist. While her previous role focussed on the treatment of workplace injuries and the implementation and management of an ongoing and evolving workplace wellness program, the focus of her new role, was to develop and maintain preventative measures, usually effected through either administrative, technical or behavioural programs, and often a combination of all three. While success in her previous role as a nurse required significant ‘technical’ knowledge in the medical field, her current role, as an occupational health and safety systems specialist, required technical expertise in an entirely different field. As Jo explained:

My background is not technical but I work on a very technical site, so for me, my whole time here is about learning. My expertise is in the medical field where I [originally] studied, so … trying to implement our Isolation Procedure, … is something for me to learn over time.

Jo’s assignment, explored in this case study, is one that is critical to maintaining both the integrity of the plant and the health and safety of those who operate and maintain it. Jo must bring together all of the site’s varied and disparate approaches to energy isolation, more commonly referred to as LOTO (Lock Out Tag Out), into a single
coherent site wide system that will satisfy both the internal organisational requirements and those of the state safety authority, WorkSafe Victoria. What is required by both, is a site-wide standardised system, that will ensure that mechanical and electrical sources of energy are isolated, and all risk removed, before any maintenance work can proceed on any part of the plant. This might seem like a logical thing to do, but, according to Jo:

What happened was we had a number of external audits. We had a corporate audit that found a problem. No one did anything about it! They said, oh yeah the corporate audit said this, and then they had Safety Map come out, because we wanted to achieve Safety Map as part of our Occupational Health and Safety Management System. No one did anything about it, and then, WorkSafe came in and they gave us an Improvement Notice, and finally, everyone said: “Shit! We better do something here!” And that’s when the Maintenance Group lifted their game and actually followed the existing procedure. Not that, that was the ideal, it wasn’t the ideal procedure, but at least they then started to follow it. So it was that shock, I suppose, that’s a learning thing, you know immediately, the threat of being shut down or something, and there is some kind of very negative consequence coming out of it then, you’re going to do something about it.

Although the issue of the Improvement Notice represented a significant safety non-conformance as well as an obvious embarrassment to management and others in the organisation, the effect it had on Jo and her situation was quite positive. As she explains:
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I was happy as Larry. I thought that is the best possible thing that could have happened to the site because it takes some amount of pressure on this site to actually get people to make any changes. So, to me, I thought, this is fantastic!

This is just what we need as an avenue for change.

Though the Improvement Notice represented a positive outcome for Jo it didn’t provide her with any answers. However, it did change the internal political climate somewhat. An Improvement Notice, issued by a WorkSafe Inspector, is a legally binding notice to improve an unsafe situation and comes with quite explicit expectations, a time period in which the problem has to be acted on and penalties if appropriate action is not taken in time. This doesn’t mean a fully implemented solution, but it does require, at a minimum, a management commitment and a formal plan of action, that must be followed. To Jo this meant that:

We had a date that we actually had to do something by. We had to implement certain things. So it was initially to follow what the existing procedure was. Also coupled with that was more pressure from corporate to implement additional things like what we call energy isolation procedures and valve locking procedures. So that was also a requirement, but that’s been on the boil for three or four years but no one’s actually done it and everyone’s always said no, no we’re not going to do it. But, what I also find difficult in this organisation, is knowing how to move this forward. I didn’t know!

Not knowing quite how to proceed, Jo decided that the best course of action was to go and find out what was happening in the field. It was not until after she met with the plant managers and other stakeholders that she discovered that the issue at the
heart of the problem was that the existing procedure was not being followed by any of the manufacturing plants. Jo recalls the outcome of these meetings:

I think I’ve said that I don’t necessarily have a lot of support from my manager because he doesn’t assist me in making those judgements, he expects me to come up with stuff and then he might just talk to me about it. But in implementing our isolation or LOTO procedure I started from a point where I had this absolute ignorance. I went and sat in with a group of men who obviously had been doing it for years and had experience in the plant and knew, for some reason, that it wasn’t working properly. We weren’t following the procedure.

For Jo, this raised two critical questions:

Why weren’t we following the procedure? What’s the consequence of not following the procedure and having no consistency across the site?

To Jo this presented a serious problem. The LOTO procedure was designed to ensure that any form of energy, that could cause injury or damage while maintenance work was being carried out on the plant, was properly isolated. This meant that sources of power had to be isolated from motors, that pipelines that might contain chemicals or pressure were properly isolated and that any mechanical devices were prevented from being activated. This is done through a process of isolating motors and then physically placing a lock on the isolation mechanism, removing mechanical linkages, inserting blinds into pipelines, hence; Lock-Out. Then, placing tags at these isolation points to identify the job and explain the reasons for the isolation,
Tag-Out. This is all done in conjunction with a “permit to work” system. Together the LOTO and “permit to work” system are designed to prevent injury and or damage and in many cases the potential for both is significant. If the procedure is not being followed the consequences could be dire and, of course, Jo is particularly worried that if the procedure is not followed then:

There’s going to be a bloody accident, there’s going to be a serious, serious accident, and, at the end of the day, we’re going to be hurting people at so many different levels, and the organisation’s going to lose money because we’re going to be sued or you know; whatever! So I suppose in terms of that experience it has been trying to understand what the existing procedure was and then work out how it was implemented and then making changes to that procedure so that it could be implemented in a new way.

Jo’s response to her situation is both rational and emotional. A rational analysis of the situation is that the lack of a coherent and uniform approach to LOTO on the site may well result in injury to employees and or damage, and financial loss to the company. However, on an emotional level, Jo is particularly concerned and anxious that an injury or worse may result if the current situation is not rectified. Choo (1998), Billett (2004) and Jarvis (2006) point to the feeling of disequilibrium, unease or the experience of disjuncture with a situation as the point where the learning process is frequently initiated and that the process of trying to resolve this sense of unease as being the problem solving and learning process. For Jarvis, though, it is not just the use of emotional feelings as a trigger for learning but the role of emotions in the learning process itself that is of most interest. As joint motivators, Jo now had the need to meet her original and quite pragmatic goal of devising and
implementing an effective uniform LOTO procedure, one that will not only satisfy the corporate auditors and more importantly WorkSafe, but also, now, the visceral one of eliminating the feeling of discomfort or unease that has developed as she has come to fully understand the ramifications of what might happen should the current situation be allowed to continue.

Although Jo now had a clearer understanding of the situation, she still wasn’t sure how best to proceed. She did know that she needed to develop a strategy that would ensure that a new and effective procedure was developed, but just as importantly, she also knew that she had to overcome resistance to the changes from both the plant managers and the General Manager (Operations). This powerful community of engineers had been the main resistance to change despite the findings of the corporate audit, SafetyMAP recommendations and WorkSafe. While Lave and Wenger (1991) have rightly identified the positive learning aspects of communities of practice, these same communities can be resistant to some learning opportunities, particularly if the opportunity should come from an outside source that is not recognised by the community. For Jo, getting heard by the engineers meant that:

*In terms of making the changes to the procedure, what I did say and kept highlighting to management, was that we are going to have an injury here, if somebody doesn’t follow the procedure correctly. We had a couple of examples on the site where there was one pump that was supposed to be worked on, but they isolated the incorrect pump, and they were working on a live piece of equipment. A number of people are trying to clarify points within the plant of what constitutes an isolation. Do we have to pull fuses? Do we have to put in a physical barrier? I don’t know! I went and asked the electrical engineer, his*
opinion was different to what was practised on the site. So what I did was, I went and lobbied a particular person in the I&E [Instrument & Electrical] Department, who I thought was pretty good, and he’d also had similar thoughts to me, and what we did was, we came up with how we were going to make the changes in the procedure. Because he’d already been knocked back in the past by the GM Operations, he was very disappointed, I almost lost him, and then when we got a change in management, I went back to him and said: “Come on, I need a little bit more help with this. Are you prepared to get involved with it again and make the required changes?” And that’s sort of where we went.

The link here is with Jo’s difficulty in connecting with or being recognised by the community in which she needed to promote her (and her organisation’s) agenda: the uniform adoption and application of an effective LOTO process. Wenger (1998: 104) uses the term ‘brokering’ to describe “the connections provided by people who can introduce elements of one practice to another.” This is how Jo was using the I & E technician. In realising that she cannot a) understand the technical aspects of energy isolation as well as she would like to, and b) be recognised by the plant managers (all engineers) as being in a ‘technical’ and somewhat respected role, she connects the I & E technician, as the broker, to introduce her and the LOTO procedure into the plant managers’ community of practice. While success is not guaranteed, her chances are significantly improved as a consequence of this ‘brokerage.’

A second important aspect in securing this particular ‘broker’ was the change in management. Not only did this change facilitate the re-entry of the broker into the process but it also meant that a significant barrier to the change had been removed.
This change of management also represented the changing of a significant influence on the ‘community of practice’, the most significant barrier to the change that Jo was trying to introduce. Although significant, this change should be seen for what it was, the removal of a barrier, and not a change in overall attitude to, or acceptance of, the idea of a new and uniform LOTO procedure. Jo and her ‘broker’ still had that work ahead of them. Jo explains that one of the biggest issues:

…was that there was no agreement between the operations side and the maintenance side on how the procedure should be done. And, I think that was one of the big problems, as well as the problem that every issuing department was doing different things as well. They were isolating in the way they thought they should be isolating.

Both parties have responsibility but the issuing side is the side that is required to do the isolating. Maintenance then check to make sure that everything’s been isolated correctly and then the maintenance sign off. The big thing was to bring the two groups, maintenance and operations, together to have a meeting and work out who was actually going to be in control of isolating.

Getting the two groups to agree on a standard site-wide practice was quite critical to the whole process. While there may have been several independent operating departments, which were actually separate manufacturing plants rather than a series of interconnected manufacturing departments, there was only one maintenance department that was shared by the whole site. If a unified approach wasn’t important to operations, it was to maintenance. Under the existing system, maintenance personnel were moving from one department to another and having to readjust to
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each department’s particular LOTO system. A single site-wide approach would mean less confusion, and inconsistency, and a greatly reduced risk of injury or damage to plant and equipment. Jo explains this confusion below:

*We have a series of tags, you have your Danger Tag, you have your Personal Danger Tag, which is for maintenance, and you have a Warning Tag, which was always on site, but no one knew why the hell they used it. Well some people were taking the tags off and leaving the lock there. Some were taking the lock and the tag off. Some were just leaving the maintenance tag there. And so the department wouldn’t know why it was supposed to be there in the first place.*

*And people don’t seem to understand the need for a trail of information. I mean a job may go over many days. How do you know that things haven’t been changed over the period, if you’ve been away for a week? And it’s also about the risk perception, I always think. What are they prepared to accept in terms of the level of risk? And people don’t seem to have a very sophisticated understanding of that. In my view – I don’t know if its selfish, I don’t know what it is – but they seem to have an, ‘it’s not going to happen to them’ attitude. It’s not going to happen. They don’t perceive it as being a risk because they know the job. They’ve done it for a hundred years and they’ve never had a problem. But you never know!*

With the change of management, and her alliance with the I & E technician, things finally started to fall into place, and Jo could bring the parties together and restate her case for change with a reasonable expectation that she would at least be heard. Jo explained that:
Trying to get people to all think in one direction in this organisation is practically impossible. So what I have done has been to do a hell of a lot of discussion, a hell of a lot of lobbying, a hell of a lot of inspections and audits, and all that kind of stuff. Then bringing it all together, then move to the next phase of actually making a change to the procedure. Going through the recommendations of what it should be, and then coming up with an idea. But, then making other people think that it’s really been their idea. Then bringing it all together so that I could go and talk about it with individual departments and then everyone says: “Oh that’s the way it’s happening!” And then they’ve sort of got the idea themselves and then we sit down, bring the parties together, have a meeting and then get an agreement on something.

Here Jo gives us an important insight into her thinking at the time. She is clearly focussed on the bigger picture, while at the same time, working through a process that requires that she pay particular attention to each of the smaller parts, that is, the individual Plant Managers. Through this phase of her project Jo has decided that the best course of action is to approach each Plant Manager, individually, with the aim of gaining a clearer understanding of the problems with the system, as well as an insight to their perceptions and needs. At the same time, she is giving herself an opportunity to do some one-on-one lobbying. All of this is supported and reinforced by her auditing of the various production plants in their application, or compliance with, the sites existing LOTO procedure. Her one-on-one encounters with the Plant Managers allow Jo, through an evolving iterative process, to gain personal knowledge of the Managers and their views on LOTO, as well as allowing them to gain some personal knowledge of Jo and her goal. Through these encounters, Jo is
building relationships and gathering knowledge that will prove crucial to her plan. While these conversations allowed Jo to develop a more personal rapport with the Plant Managers, the knowledge she gained through them and her auditing provided Jo with the information she needed to make the changes she had to make to the LOTO procedure, and make a more substantial and persuasive argument for change.

In the second phase, “bringing it all together,” Jo is able to make changes to the procedure that can be accepted by the Plant Managers, because they have – through this iterative process – not just been included, but have become a part of, the change process. The discussions with Jo have allowed the parties to exchange important information, which has been used to formulate and justify the changes that Jo eventually made to the procedure, and in the case of the Plant Managers, to develop crucial insights into the key issues underpinning the need for change. These phases represent the formation of ‘purpose’ for Jo, the purpose of collecting persuasive evidence to support her case for changing the existing procedure, the purpose of building relationships and gaining the confidence and trust of the Plant Managers, and, of course, in doing so, the making of judgements through which the Plant Managers could be influenced, accepting the changes, as their own, and eventually enabling Jo to realise her goal of a uniform, site-wide LOTO procedure.

In the end Jo did get her changes through. The site now has a uniform, site-wide procedure for isolating, locking-out and tagging all maintenance work. It also complies with both corporate and WorkSafe requirements for LOTO, and in Jo’s own words:
It’s been a long drawn out process, but I’ve learnt so much out of it I think I could tackle any isolation procedure now, I feel quite comfortable with it.

The process outlined above has been both a frustrating and rewarding experience for Jo. During the course of this project, she has learned much about isolation procedures, enough, in fact, to give confidence to tackle another LOTO project. Beginning the whole process as a novice, still relatively new to both her role and the wider field of Occupational Health and Safety Management, Jo has learnt enough about isolation procedures to feel that she could tackle “any isolation procedure now.” But it’s not just isolation procedures Jo has been learning about. Another key aspect of her role as a Health and Safety Specialist is that of change agent, and during this project Jo has learnt several important things about managing change that she can take into any future project, whether it is an isolation procedure, or something entirely different. While she may not be able to remove all obstacles to change, she is able to identify them and where she is able to, develop effective strategies for getting around them, as her decision to enlist a broker has shown.

Jo had two clear objectives, to develop a compliant LOTO procedure, then implement it across the site. Jo knew in advance that the LOTO procedure was deficient, three audits, one internal and two external had told her that. One had even resulted in a legally enforceable Improvement Notice, from the state’s OH&S authority. What she needed to know, was what changes would need to be made to make their LOTO procedure compliant, and what would need to be done to get the new procedure applied uniformly across the site. During her journey we see three evolving examples of how the construction of purpose has allowed Jo to move
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forward. First her purpose was to seek information that would allow her to understand the nature of the ‘current’ situation. Second, she made the purposeful link to the ‘broker’, and the access that he could provide into the community of practice that was the site’s Plant Managers. Finally, Jo showed purposefulness in constructing an iterative process, initially through her one-on-one meetings with the Plant Managers, and then through meeting with them as a group, resulting in the groups’ ‘ownership’ of the new uniform LOTO procedure. As Jo explained above:

*Trying to get people to all think in one direction in this organisation is practically impossible...[but she managed to].*

As Dewey has claimed (1938: 69), purpose involves observation, knowledge and judgement. Jo’s observation of the surrounding conditions, environment and context told her that not only that there were problems with the LOTO procedure, but with consistency and attitudes towards LOTO across the site. The personal knowledge of the subject and problem that Jo brought into the project was sparse, but she engaged in meetings and alliances, that provided her with the knowledge she needed.

Entwined in Jo’s struggle for recognition and change, we can see evidence of Illeris’ (2002) three dimensions of learning – cognition, emotion and environment – where Jo is dynamically engaging with her problems cognitively and emotionally in a workplace environment that is socially contextualised through her manager, the group of plant managers, the maintenance team, and her broker, the I & E technician. Jo’s emotional engagement is clear in her concerns that people may get hurt, or worse, if the situation should be allowed to continue, and again with her frustration
with her manager and her difficulty in connecting with the plant managers. Cognitively, we see her effectively process information about the situations, deciding to undertake her own research into the issues and seek out someone who can broker her entrance into the plant manager’s community of practice. The uniqueness and complexity of the work environment, and the social interactions that connect with the cognitive and emotional dimensions of Jo’s learning experiences, can all be seen at work, as Jo initially struggles, then formulates evolving purposes, and finally, in doing so, achieves her goals.

However, we can also see, as Jarvis (2006) explains, that this has been part of a continuous learning experience for Jo, an experience that, perhaps, is but one small chapter in Jo’s ‘life-world’. This ‘life-world’ that includes all environmental and contextual possibilities, the learning experience, reflections on it and the emotions encountered, and of course, her actions based on her thoughts, and the changes that all of this have made to Jo, the learner.
Case 8: Liz and a clash of cultures

Liz is an experienced telecommunications engineer. Born in Scotland and raised and educated in the UK she immigrated to Australia with her husband in the early nineties. Just before the time of this case study, Liz was working for a large Australian telecommunications company designing and constructing analogue and GSM telecommunications networks. Then Liz was offered, and accepted, an opportunity to work in Indonesia. This involved leaving secure and stable employment in Australia and moving, with her husband, to Indonesia. On arriving in Jakarta, Liz was provided with a car and driver, an apartment and a maid. Not only was she a foreigner, new to a strange country and culture, but it didn’t take her long to realise that her employment conditions were significantly better than those of the local Engineers with whom she worked. Many of whom she came to consider her contemporaries, and yet others, because of their knowledge and experience, she regarded as being senior to her. Liz explains the situation:

*As an expatriate you’re very wealthy. We were paid well compared to Australian standards, but compared to how people in Indonesia were living it was like we were multimillionaires. Though this was quite odd, it was normal practice if you were an expatriate, to get all of these perks, and very high salary. And yet, you were working alongside people who were your peers, and people who were much more senior, who were getting the local wage, which was very low, and didn’t get any of these perks. And of course, there were a lot of foreigners going into this environment, and I can imagine that it would have been quite difficult for these people (the locals), to see an influx of all these foreigners coming into their environment, going into senior jobs as managers of the local staff, who had been working in that environment for a very long time,*
and who were competent but didn’t have the design or technology skills to do
the job that needed to be done. They [foreigners] had to be hired from outside
because in 1996 there were very few people who had GSM telecommunications
design experience. I wouldn’t say it was a hostile environment at all, that we
walked into, but certainly there were class distinctions between rich and poor,
and yet intellectually, and probably educationally, we were quite equal.

There was a lot of, not hatred, but jealousy, or feeling of unfairness, that we
(expats) were getting paid so much money and this was always underlying, no
matter how kind or how helpful or how friendly you were, it was always
underlying the surface. So there was always that bit of animosity, I think, that
was there. We’d drive in our air conditioned, chauffeur driven cars, and they’d
come in sweaty busses. It had been communicated to us, by Indonesians that
had gone overseas before, that this was something they were finding difficult to
deal with.

As we can see from Liz’s own comments, while she accepted that it was necessary to
import international expertise for this significant national project, she still felt
uncomfortable with what even she considered extravagant salary and conditions. In
a very real way these additional benefits served to widen the gap between the expats
and the locals, perhaps even adding additional tension to what was already a difficult
situation.

This was Liz’s first experience with a non-Western, and, in particular, a non-Anglo
culture, her new role had very quickly taken her from a familiar, Anglo/Australian
culture, to a completely foreign Asian/Indonesian culture. With no training to
prepare her for the transition, and no knowledge of the language or culture, Liz suddenly found herself in Jakarta, leading a team of Indonesian engineers. In just a few short days Liz’s world, the one she had known all her life, had been turned upside down. She was in a foreign country, with a foreign language and foreign culture and was expected to lead a team of engineers that she had never met, and knew nothing about, through a 2½ year project to design and install a local GSM telecommunications infrastructure. But we can also see that very soon after arriving in Jakarta, Liz is aware of, and sensitive to, the key differences between the expatriate engineers and the locals, and she is also aware that these differences might serve to exaggerate the pre-existing cultural and language differences.

As the manager of the design engineering team my task was to take the specifications of the contract and design the network and prepare all of the documentation to hand to the subcontractors who would build, actually construct, the network. I had a team of about 20 people, mostly male engineers, but there were a couple of girls as well, and I thought that quite unusual and quite pleasing as well. So, of course, going into that environment, any new job you go into, you’re always going to have a breaking-in or settling-in period where they suss you out and you suss them out.

Though pleased with the make-up of her team Liz is also aware that there will be an initial period of learning about each other and what people are capable of on both sides. Liz soon realised that this was going to prove to be both revealing and challenging:
I didn’t know anything about Indonesia because this job came up so quickly.

Had I done my research, I would have realised that it was part of their culture, that when I asked: Do you understand this? They would have answered yes, quite enthusiastically and quite confidently. I would say: “Can you have it done by the end of the week?” And they would say: “Yes, no problem.” The end of the week would come, and the product wouldn’t get delivered. Not only was it not delivered, but they hadn’t started it, and they didn’t know what to do.

Although Liz had already acknowledged that the cultural difference would have an impact on her and the project, this was her first concrete example of what some of those differences actually were. And it was not a problem that she had anticipated. She knew all of her team were qualified to do this type of work but it seemed that they just weren’t able to do it.

Initially I found this to be quite odd because the lessons that you learn in business is that you delegate, you clarify your instruction for someone to undertake a task, you give them a timeline and you also ask them if they need any help and to follow-up with you. I applied all of those normal management/business rules to this environment and found that I got nothing at the end of it.

It soon became evident to Liz that Western management practices were not going to work in Indonesia.

I learned quite quickly that, in that particular culture, people don’t like to say they don’t understand something, they tend to say yes, and they agree, because it’s shameful for them to say that they don’t. This was extremely difficult,
because how then are you able to ascertain whether the message has got across, because you would never ever find the local engineers say to you that one, they had a problem or two, that they didn’t understand something.

How am I going to know if the engineers have understood, because they’re telling me they understand things when I’ve explained it to them, and subsequently, I’ve found out later that they haven’t? How am I going to be able to satisfy myself that the message has got across?

In these last comments, we can start to appreciate the frustration that Liz must have been feeling when she realised that the management practices that she had been reliant upon, just wouldn’t work in this situation. Realising that effective communication was paramount to the eventual success of the project, the first problem Liz focussed on was team communication. How could Liz be sure her instructions were understood if the local culture dictated that communication would be all one way, from Liz to the team member? How could she be sure that her instructions were understood and that problems were reported? A second, and, for Liz, a potentially more disturbing problem, was the quite different appreciation of time between the two cultures.

More challenging was that a project is all about timeline, and timeline is all about money. So I was quite conscious of being able to deliver the product on time, and found it quite frustrating in the first couple of weeks when the tasks just weren’t being completed. Not only that, there didn’t seem to be any kind of consciousness of time. Things took as long as they were going to take, and that was almost the complete opposite of what I had learned in Australia and the
This second cultural disjuncture really concerned Liz. Of the two problems she had identified in her first few weeks this was the one she saw as having the greatest financial impact on the project. If her team couldn’t appreciate time as it related to the project objectives, how could they achieve them? This difference in cultural conceptions of time affected even the routine activities of the design team including, the more formal communication ritual of the project team meeting.

This flowed through to things like meetings. You’d say we are going to have a meeting at 9 or 10 o’clock and people turned up at 11:30, quarter to twelve. I mean, not just half an hour late. Not an hour late. But sometimes, up to 2 hours late, and it’s perfectly acceptable. It was like normal business practice, and I found this at very senior levels, as well as at the regional project team level that I was at. Quite often you’d turn up for a meeting and people just wouldn’t turn up, or would turn up two to two and a half hours late. Immediately I thought: “Oh my God! How am I going to be able to deliver the project to the timelines when there is no concept of time?”

By now we can see that Liz’s frustrations are building significantly, while her initial concerns about team communication and competence were serious enough, she finds that the importance of time, probably the most critical aspect of any project because of its capacity to affect its cost, is not understood or appreciated by her team. It’s still early days for the project, and already, Liz has a list of team problems that are
all critical to its success, and would have many project managers tearing their hair out in frustration.

To address the problems relating to team competence and communication Liz decided not to impose what was to her, a familiar and up until now, a proven approach to management. It had become quite clear to her, very early on that neither, her tried and trusted Western style of management by delegation, nor the adoption of a more directive, command and control approach to managing the team, would work for her in this situation. As Liz explains:

*I think that in terms of people management skills, I couldn’t apply the skills that I had used in Australia, because the fundamentals, the principles of delegation, of communication, of confirming that things were understood, that timelines were understood, were all so different. I couldn’t apply that there, at all, and of course as I said earlier, the whole thing about delivering a project to schedule, is about timing and getting particular activities done on time, and in an environment where time means very little, this was a huge challenge.*

Liz decided to adapt herself to the situation, rather than make the situation adapt to her. If GSM was new to the team, then she had to teach them. In the past, Liz had done quite a lot of teaching of mathematics, at both the Higher School Certificate (HSC) and University levels. The idea of teaching came quite naturally to her, so she just simply applied the skills she’d used as a teacher to her work situation.

*I’d actually done a lot of teaching in mathematics, sort of as a hobby you could say, I taught high school students HSC maths, and I also taught some people*
going for their officers engineering qualifications at university, first and second
year level mathematics as well. I just basically applied the skills I had used
with them.

In this clear example of assimilation, we see how Liz is able to relate her situation, as
foreign as it is, to something familiar in her life. Her strategy was simple and, as it
turned out, culturally compatible. As Liz explains:

So, I think on the learning side, I thought, I’m going to have to force them to
demonstrate to me. If they can’t tell me, then I’m going to have to set them
tasks. So what I did was set little exercises, almost like working examples.
Give them homework you could say, and I thought that if I give them basic
design questions, teach them and draw in their book with them. And, almost
like a teacher, give them some questions to answer, based on the activity that I
wanted them to do. They needed to demonstrate to me, before they felt
ashamed that they were unable to do what I’d asked them.

I took an example and separated it from their work so that they felt more
comfortable with the task, and I got them to basically do homework and come
back to me and explain to me what they’d done, and how they’d done it,
because I didn’t know if they’d given it to someone else to do it. In the first few
months, I would sit down with them and watch them as they logically and
analytically worked through the problem. Step them through in a detailed
fashion, give them maybe ten steps, and irrespective of how easy or how hard
the problem was, force them to go through the ten steps. Getting them into a
routine, not skipping from step one to step five, even though you could do step
two, three and four in your head, I made them go through all the steps. When they had done that, I would give them a design to do.

Of course it wasn’t quite as simple as setting ‘homework’. This all had to be achieved in a culturally sensitive manner, as Liz herself points out, and by a person who was still quite new to the culture herself. In a very short time, Liz had attuned herself to several critical aspects of the Indonesian culture, and began to incorporate them in to her management and communications styles. The ‘losing face factor’ as Liz put it, was something that she had become acutely aware of. The strategy Liz decided on effectively eliminated the risk of the local engineers losing face because they did not know what to do. Not only did her approach alleviate the risk of losing face, but it also ensured that the engineers on her team would be given an opportunity to learn the skills needed to do the job. But the critical factor in the success of this strategy was discretion. This meant Liz had to do it all, one-on-one:

I found, I think, that they had been quite scared of doing this new technology because they had never done it before. I also had to be very careful in that cultural environment not to offend, or have them lose face. If someone had done something incorrectly I’d be quite discrete about communicating that to them, I had to be careful not to have anyone around so they could hear what I was saying to them and that sort of thing. So there were a lot of people skills that I’d never really had to worry about before, that I had to just draw from somewhere. I became quite conscious, quite quickly, that in the environment I was in there was this losing face or embarrassment factor of doing something right, or not knowing how to do something and being careful how I communicated with them while they were undertaking the task.
Liz’s insightful observation, above: “So there were a lot of people skills that I’d never really had to worry about before, that I had to just draw from somewhere.” Tell us one of two things; one, that she was drawing on knowledge that she didn’t know she had, that is, tacit knowledge; or two, that she was constructing new knowledge based on her observations of the situation combined with any relevant pre-existing knowledge that she may have had, which may also have been tacit. This candid admission, as she tries to explain how she developed a strategy for managing her team, sheds some light on how we are able to solve problems yet are unaware of exactly how. Some have called this intuition. Yet it is also quite clear from her adoption of the “teaching” strategy outlined earlier, that its genesis sprang from her previous teaching experiences with HSC and University students. This experience also provides evidence of Dewey’s (1938) purpose, as Liz takes stock of her situation, using her observations and accumulated knowledge, she makes a judgement that the solution to her immediate problem is to adopt a discrete and focused training program.

But Liz is more interested in solving her problems than she is in understanding where her insights have come from. As she continues to explain:

\[ I \text{ knew I was going to be working with these guys for the next } 2\frac{1}{2} \text{ years and had to get the job done, so I basically invested a lot of time and effort up front, hoping that I was going to get a return. I got them trained up quite quickly but I had to do it on an individual basis. You couldn’t do it in a group because people could see that a person might be falling behind. I thought that was quite odd, and I think that had it been an Indonesian person } \text{ in my role} \text{ maybe that it might have been different because obviously they’d been to college, } \]
they’d been to Uni. They must have been in class type environments before, but I was a foreigner, I was female. I was trying to teach them something that was quite new, they had the basic skills but they didn’t have the GSM skills. I basically got the team trained up to start doing designs but I had to check and approve everything.

While her strategy was successful, and the engineers on her team were able to develop many of the necessary skills and the knowledge required of a GSM design team, there were still some aspects of the relationship that she could not “normalise”.

I really tried to encourage them to come back and ask questions but found that no matter how hard I tried, and how open my approach was, for them to come and ask questions, which was stock standard here in Australia, they would never ever do that. So I had to satisfy myself that what they had undertaken, they had understood. So I think that in terms of being conscious of the male, female thing, the culture and the embarrassment thing, not wanting to say that they didn’t understand was one aspect that I had to pick up really, really quickly.

But when you teach anyone something new there is that need to interact, so that you can say, yes they’re understanding what I’m saying, because of course my accent [Liz speaks with a pronounced Scottish accent], any foreign accent, can be difficult to understand. Do you understand what I’m saying? Is there anything you want to ask? That interaction was never there, even after 2½ years, the admittance of I don’t know how to do something, or can you show me how to do this again. Never!
Of course, maintaining the workload that being both manager and teacher to twenty engineers demanded, in the long term, would have been impractical. However, by observing the group dynamic, Liz had noticed a few ‘natural leaders’. People she referred to as ‘chief guys’ who seemed to be looked up to by the others.

*Then what I did was, I quite quickly latched on to a couple of the smarter guys, and I watched the team dynamics and I could see that some of the guys would go to these, you know “chief guys” who were the same age but obviously respected by the other guys, and I quite quickly latched onto that and made them almost like team leaders, without making them team leaders, because the hierarchy thing was important. Not to distinguish between people, because they were equals. I would then focus on teaching them [the Chief Guys] and then get them to communicate that message back to the others. They obviously seemed more comfortable working with these guys, and not as embarrassed when working with me. So that was the approach I took to get them to do the design.*

Although Liz had addressed, and largely solved, the issues of competence and communication, the local concept of time was deeply ingrained. Again Liz judged that trying to change the locals by adopting a directive, command and control approach to managing the team and trying to force her concept of time onto the local engineers, would probably do more harm than good. Instead, Liz decided that rather than make the situation adapt to her, she would have to adapt herself to the situation. Liz explains that:
... in terms of the time and timing, that was a problem that never went away and was probably never going to go away, it was part of their culture. Having meetings was something we couldn’t have because you could never have a meeting and have everyone turn up at the same time. So the question is: how do you communicate with the team, when you can’t do what you would normally do? That is, call a meeting, and have everybody sit around so that you could pass on information. So it was done in small groups, you would tell people as you saw them because you couldn’t gather everyone together and this was something I picked up on in the first month to six weeks, and in terms of getting things delivered on time, I had to continually follow-up. Usually, if I could, through these “Team Leaders” [chief guys] to say could you make sure I can get this by the end of the week and get them to chase them up rather than me chasing them up directly, and I think that worked quite well.

While the strategies adopted by Liz had proved largely effective, allowing her to move forward with the project, and confident that she could manage the team and the project to a successful outcome, this didn’t mean that she was always comfortable with the situation. Liz explains that:

Although I got quite frustrated that things took a long time to do and even though the job didn’t get done the same way that it had here [in Australia] it still got done, and it still got done on time. It just got done in a very, very, different way. By going through a different set of steps to what I’d gone through here.

What I found was that they would communicate second-hand, somebody else would come and tell you that someone else had a problem or weren’t going to
be able to get their report out on time or didn’t understand something that I’d communicated to them earlier. The individual themselves would very rarely, if ever come and say that. It always came from a second or third party, which was quite unusual, so a lot of this stuff had to be done by rerouting the information. It was almost as though information went through an advocate, it was quite bizarre but at the end of the day, 2½ years later, the network was built, successfully tested and handed over. The job got done, but how we actually did the day to day business was through these third parties. You’d pass information over, you couldn’t necessarily talk directly, and the timing was just incredible, you just couldn’t communicate to teams like you would here.

The management skills were something very foreign to anything I had used before, like teaching the engineering side of it and the communication that had to be reinforced in a different way to anything that I had experienced while I was working here in Australia. So I think that’s probably a good example of taking a tried and tested solid set of principles into a different cultural environment, one that was politically sensitive at that time, as well as the issue with the money.

Having worked with her team for some time, getting to know them and their culture, Liz had developed an understanding and acceptance of the Indonesian way of doing things. As we have seen in this case, there have been many points where Liz has had to make critical judgements on how to proceed. To date, her judgements have been all quite successful, resulting in effective strategies that allowed her and her team to deliver a project on time and on budget. She built the team’s skill base leaving behind a legacy of engineers who were capable of working with a GSM network.
Making judgements is part of our everyday lives. What our judgements do for us, is to provide a pathway that allows our journey to continue. Not making judgements means not taking action. We must, if we intend to continue our journey forward, make judgements that sometimes open doors and sometimes close them. Either way, the judgements we make at work, and in life, can sometimes keep us on a familiar path and sometimes help us blaze trails into unknown and, at times, uncomfortable territory. It is when we encounter these new and unfamiliar pathways, pathways that create a sense of disjuncture within us that we continue to move forwards, making judgments until our problem is solved and our sense of disjuncture dissipated.

Liz’s experiences in Indonesia present a complex weave of cultures, values, judgements and learning. Right throughout this case we have seen Liz first, identify key issues and then make judgments. In many of these instances, Liz was in what she thought to be, familiar territory that actually turned out to be quite alien. She would make decisions that would have significant consequences on both fronts. At its heart is the ‘clash’ of cultures that Liz experiences in both her professional and personal life. From a professional perspective the outcomes have all been quite positive. Liz showed an ability to identify and interpret key cultural issues and quickly make judgements that allowed her and her team to move forward. These judgements, we can see, are based not only on an interpretation of the situation but must be heavily influenced by her values and feelings. Unlike some of her expatriate colleagues, Liz had adopted an approach which required her to adapt to the local culture rather than try and make the local culture adapt to her.
Dewey (1938: 68-9) is quite clear. The formation of purpose is an intellectual operation that involves observation, knowledge and judgement. Dewey (1938: 69) defines knowledge as: “Knowledge of what has happened in similar situations in the past, a knowledge obtained partly by recollection and partly from information, advice, and warning of those who have had a wider experience.” However, through Liz, we can see that sometimes all we have are our observations, and what we already know, and it is upon these that we base our judgements. When Liz arrived in Indonesia, she knew nothing of the country, its people or culture, and all of her management knowledge was based on Western methods and experience, and she had little relevant knowledge of her own, or that of others, that she could draw on. Liz clearly had several purposes in mind, for example, developing the team’s knowledge of GSM networks, and being able to communicate effectively with her team. Relying only on her observations of the team and their culture in the workplace, and her limited experience with teaching, she is able to make decisions that allow her, and her project, to move forward to its intended conclusion. We can also see Illeris’ (2002) three dimensions – cognition, emotion and environment – as Liz negotiates her way through these issues. Jarvis (2006) describes a learning process that is richer still. As Merriam (2007: 101) explained:

*The learner is more than a cognitive machine. The learner is a whole person made up of the mind and the body and comes to a learning situation with a history, a biography that interacts in individual ways with the experiences that generates the nature of the learning.*

The telling factor in the experiences that Liz has recounted for us above, is the contribution that Liz’s life history, the sum total of all that she knew, both tacit and
explicit, must have made to her decision-making processes. As we can see through the story that Liz has told, her approach to the situation was probably unique amongst the expatriate managers on the project.
4.3: Summary: constructing meaning and self

As shown by Jarvis (p92 above), the learning process involves the whole person, body and mind, an experience, and the subsequent integration of this experience into her or his individual biography resulting in a changed person (Jarvis, 2006: 13). Jarvis described the sum of our life experiences, not as ‘just’ knowledge but as our biography, meaning all that a person is, at a particular point in time including, but not limited to, what we know (pp32-34). Similarly Beckett and Hager explained (p37): “It is the person, not merely the mind, which is significant, and persons are inevitably embodied” (2002: 40). According to Jarvis (p70), learning begins with “a disjuncture [a separation or disconnection] between our biography and an experience – an incident that, at the time, a person is unprepared to handle” (2006: 100). This disjuncture occurs when the sum of our experiences (our biography) is unable to provide us with the information we need to continue when something we are unfamiliar with is encountered. We are unable to cope with the situation and are consciously aware that we do not know what to do. Jarvis explains that: “We have to think, to plan, or to learn something new. Learning then, always belongs with experiencing (Jarvis, 2004: 93 in Merriam, 2007: 100).”

According to Choo (1998), the central knowledge activity is to resolve ambiguity by asking questions like: What is happening? Why is it happening? And, what does it mean? By asking these questions, we begin to make sense retrospectively by comparing the unknown that we are experiencing now, with what we have experienced in the past (p46). Similarly, we read that for Piaget (1976: 111-2) overcoming ambiguity, brought about by an encounter with the unknown, involves making sense of this unknown information and/or situation, through the processes of
assimilation and accommodation therefore, positioning thinking and learning as one process.

Dewey (1938) explained the formation of purpose as a complex intellectual operation that involves observation, knowledge, and judgement. Observation involves the acknowledgement, and ‘taking-in’ of, our surrounding conditions, including the environment and the context in which our experiences are occurring. It also involves the ‘meaningfulness’ of what we sense (see, hear, smell, taste and touch). For Dewey, knowledge is the sum of our life experiences and includes knowledge obtained partly by recollection, and partly from the information, advice and warning of those who have had a wider experience. This knowledge will provide us with some insight into consequences, should we decide to act on what we sense. Judgement pulls together what we known and what we observe and gives them significance (Dewey, 1938: 68-9). Without purpose, our judgements and learnings are meaningless (p74). It should also be noted that in this context, judgements are enabling rather than terminating. That is, practical judgements, lead to purposeful action, not the termination of action.

In the first Case, we read how Rob experienced a sense of disjuncture, brought on by his preconception of the Capex process. That is, his pre-existing knowledge or ‘justified true belief’ (p116), hindered his completion of the Capex process. By approaching his task with the belief that he knew what he had to do to get his funding, Rob found himself unable to work through the new, business-case-based process, without coaching from his GM. His justified true belief, that the Capex system was a relatively straightforward process, that only required the completion of
a pro forma, inhibited his ability to integrate the new information about the revised process. Consequently, the new Capex system wasn’t effectively learned until after he’d been coached through the whole process by his GM. Rob may have had a very clear understanding of his goal – to buy a Learning Management System – but he was unable to bring that same clarity to identifying and defining the immediate purpose, that is, the development of a business case that would justify the expense involved in purchasing the LMS.

In Case 2, Chris has a very clear objective: to keep the blender on-line. But to keep the blender on-line, Chris must first convince the operators on shift that this is both practical and safe, and this becomes his purpose. On his way into the plant Chris reviews what he knows about the blender, the shift members and their motives. Upon reaching the plant, Chris observes the blender operation and speaks with the operators to add to what he already knows. He then makes a judgement that pulls together all that he knows and all that he has observed, that resulted in a compromise that kept the blender running and that the shift members had to agree to without looking confrontational and unreasonable.

In Case 3, Juan and Case 4, Phil, both had a very clear understanding of their goals, Juan’s ear hook machine and Phil’s 3 ½ minutes to knife, but neither had done it before. By identifying and defining purpose, at several points, as they progressed towards their respective goals they were both able to act purposefully by identifying a need, making observations, and collecting information so that they could understand their problems. Then using practical judgement at critical stages in each project, they were able to move forward, towards their goals, and as Juan and Phil,
each developed their new knowledge through this process they quickly either assimilated or accommodated it as it emerged from the milieu of their experiences.

Cases 1 to 4 also represent events that exhibit an incremental shift away from a largely Cartesian way of thinking and acting, beginning with Rob and his Capex, to a more integrated and holistic way of thinking and acting as we read Chris’ account of his encounter with the plant operators, Juan’s endeavours to design and build the ‘perfect’ ear-hook machine, and then Phil as he leads his small team to develop a plasterboard process that will deliver a 3½ minute to knife. While Rob’s thinking and acting is almost exclusively Cartesian, Chris clearly exhibits thinking and acting that is both Cartesian and holistic as he moves from thinking through his encounter with the plant operators, as he drives into the plant, to the ‘hot action’ experienced in their actual encounter. Juan’s initial thinking, his ‘imagineering’, is wholly Cartesian as it is completely separate from any action, until he begins to sketch his thoughts adjusting his ideas as he sketches, becoming wholly integrated and holistic thinking and acting as he makes the transition from planning, to building, his new ear-hook machine. Phil too demonstrates how Cartesian thinking is a precursor to more holistic thinking and acting as he moves from the initial, planning stages of his project, to the plant trials, which clearly demonstrate a holistic way of thinking and acting, as he and his small team become immersed in the plant trials.

In Case 5, we read how Rob, in a work environment defined by hot action, overcame a critical problem with the compressor settings by turning the engineer’s requirement for Rob to undertake a Management of Change process to his own advantage. By using the engineer’s own idea, he was able to have the compressor returned to its
correct settings enabling it to be returned to service. In this case, Rob’s purpose is to get the compressor started and running continuously, something that cannot happen with the temperature trip set as it was. Rob needed to convince the engineer that the temperature setting had to be increased and that he (the engineer) had the wrong, and out-dated, set-point. This was a highly emotional and time-sensitive situation where Rob and the engineer both believed they were in the right, but, in the end, it was Rob’s focus on his purpose and his rapid ‘reading’ of the situation that won the day, enabling Rob to turn the engineer’s claim that Rob needed to implement a ‘Management of Change’ process around, forcing the engineer to see that it was his ‘change’ that required the Management of Change process.

Case 6, Rob, and Case 7, Jo, describe communities of practice, usually regarded as a positive influence on both their members and their workplace, and how they initially excluded Rob and Jo, inhibiting them from achieving their goals. Both communities had as their core membership, engineers, and both tell the story of outsiders and their struggles to enter into, and influence, communities where their membership was not recognised.

In both cases our subjects were outsiders charged with implementing change within these communities of practice, communities of practice they did not belong to, and to which membership would not normally have been afforded them. Rob needed to bring his project in on time and on budget, something that had not happened with any of the previous turnarounds, while Jo needed to convince a diverse group of engineers to adopt a single, uniform approach to equipment and process isolation.
In both cases, Rob and Jo were able to identify purposes that would, once achieved, allow them both to move forward towards their goals.

In Case 8, Liz, confronted with a workforce that would not respond to Western management methods, decided to adapt her own approach and accommodate her team and their culture, rather than force her design team to adapt to her approach and culture. Throughout this case study, Liz uses *purposeful action* to resolve problem after problem, each one with the potential to seriously threaten the success of the project. On each of three occasions she identifies a purpose, observing and shaping the situation and environment, making practical judgements as each course of action was undertaken. In each instance Liz is able to achieve her purpose and to move closer to her objective, that is, to complete the design of the national GSM network, on time and on budget.

Just as Juan did in Case 3, Phil, Rob, Jo and Liz in Cases 4, 5, 7 and 8, were able to identify and define purposes, at successive stages, as they progressed towards their respective goals. They were all able to act purposefully by identifying a need to resolve ambiguity, and making observations and collecting information that enabled them to understand their problems. Then, using practical judgement, they too were able to move forward, towards their goals, each one developing new knowledge as, at each stage, they successfully achieved each purpose.

In Case 1, Rob’s attempt to secure the funding for his LMS involved doing what he believed to be a familiar and known task, that is, the completion of a Capex (Capital Expense) form. However the task turned out to be neither familiar nor known. Even
under the coaching of his GM, Rod struggled, not quite grasping what was required of him until the task was eventually completed. Yet in Case 5, he excelled in his role as Turnaround Manager, something he was apprehensive about taking on and which he had no previous experience with. In Case 1, Rob has demonstrated how a ‘false’ justified true belief can cause us to make poor judgements. In this case, Rob believed he ‘knew’ what had to be done to secure the funding for his LMS, that is, complete a Capex pro forma, and submit it to the GM for approval. Yet even with the GM’s subtle coaching, Rob didn’t quite get it right. On the other hand, in Case 5, Rob had no existing justified true beliefs to draw on to manage the turnaround. He was truly travelling untrodden ground, undertaking a project in which he had no previous experiences on which to draw, and consequently, no existing, relevant, justified true beliefs.

For all of the cases above, with the exception of Case 1: Rob and the Learning Management System, a notable feature was the emergent clarity of purpose. While Rob’s quest for a new LMS appeared clear, his objective was, in fact, somewhat ambiguous. Was it to get a new LMS (his goal) or was it to secure funding for the new LMS (the purpose)? As we read through Rob’s case it becomes clear that his focus is on the goal rather than on the purpose, that is, ‘securing funding’ for the new LMS. In each of the seven cases that follow, goals are clear but so too is purpose, in all of its instances. However rather than Dewey’s purpose, what we are observing is its logical evolution as ‘purposeful action’. Purposeful action differs from Dewey’s purpose in that it involves need, observation, knowledge and practical judgement, which results in action with an explicit and intended outcome. Observation involves the collection of information, from readily available sources, which is integrated into
our biography, all that we know at a given point in time, helping us to understand the problem. As this information integrates with our biography a solution emerges and it is practical judgement that we use to evaluate the solution and decide if it will suit our purpose. Therefore, purposeful action is the deliberate movement forward, towards the goal, which is made when we apply this emergent solution. Purposeful action, therefore, is the application of our knowing to remove or reduce ambiguity, allowing us to go on.
Chapter V

Purposeful action: An epistemology of practicality

(A Conclusion)
5.1 Introduction

In the cases above, we are seeing something far more complex than a simple stimulus response (behaviourist) or information processing (cognitivist) learning process. We have found that individuals learn holistically, by constructing new knowledge as it emerges from the observations they make of, and the actions they take in, their work environment.

What can this entail? Combining what we have learned from our examination of these eight case studies with the thinking of Jarvis, Illeris, Beckett, Hager, Choo, Piaget, Dewey and others, we see that learning is an active process that involves the whole person, their senses, cognition and feelings, as well as their embodied biography, that is, the sum total of their experiences at that time. We also see that the environment in which learners are functioning, and its context, which includes but is not limited to, the social, the technical, the socio-technical and the socio-political, must be included if learning is to be effective, and that learning occurs when an individual applies his or her judgement to their interpretation, and understanding of, what they are experiencing. Importantly, we also see that, as Jarvis (2006: 13) explained, the learning process not only adds to a person’s knowledge, but by changing their personal biography, it results in a changed person. From the cases examined we can see that in line with Hager’s claims (2001b: 8), in the workplace:

- knowledge is context sensitive;
- knowledge, as integrated in judgements, is a capacity for acting in and on the world;
• the choice of how to act in and on the world comes from the exercise of judgement;

• acquisition of knowledge alters both the learner and the world (since the learner is part of the world).

In Chapter I of this dissertation, three questions were asked:

1. To what extent is informal workplace learning enabling people at work to acquire new, relevant and value adding, workplace knowledge and skills?

2. To what extent is judgement a key enabler in the development of this new workplace knowledge? And;

3. What are the key characteristics of this informal learning?

In the following sections I answer these questions and offer suggestions for future research into informal workplace learning.
5.2 Enabling value adding learning at work

In the eight cases described above we read that the workplace can be a rich source of learning opportunities, and that these opportunities can enable workplace practitioners acquire new, relevant and value adding, workplace knowledge and skills. The six practitioners studied, Rob, Chris, Juan, Phil, Jo and Liz have demonstrated that workplaces do provide opportunities that enable people to acquire new workplace knowledge that can be applied effectively to solve real workplace problems. This new workplace knowledge adds value because of its practical nature, that is, in the case of the six people studied, it was applied through purposeful action that enabled them to move forward, and ultimately achieve their goals. Unlike classrooms, that are often void of context, workplaces are context rich, populated by people and things, a milieu of swirling discord, conflict and emotion, one that is equally rich in problems as it is in learning opportunities. The curriculum here is the curriculum of the workplace, one that provides for learning in real situations, where the consequences of one’s actions have the capacity to actually change the world, or at least the world of work, its people and things in it.

Value is added to individuals, and the organisations in which they work, through the acquisition and application of new knowledge to workplace problems, enabling people and projects to progress, proving its worth in its success. For example, Rob was able to bring his project in on time and on budget by learning how to persuade the Project Engineers, to remove non-essential items from the Turnaround schedule. Rather than forcing people to accommodate a way of doing things that would have most likely only created tension and conflict, Liz was able to bring her project in on time and on budget by learning to accommodate the local culture, and develop a
communications and employee development plan sympathetic to this culture and its people. Juan learned how to design and make an automatic, self-feeding, pneumatically actuated, ear hook machine from scratch and Phil learned how to halve the time it took to make plasterboard. This learning also adds value in two other distinct ways. Firstly, our subjects have positively changed the world in which they work by making changes that have improved the workplace and, in at least Liz’s case, the wider world. Secondly, through this learning, and the experiences associated with it, they have enriched their biographies, and consequently, they have been changed.

This type of learning is enabled in workplaces when people are given opportunities to undertake tasks that they are, at least technically, capable of doing, even if they have not had the benefit of previous experience. By allowing employees to undertake novel workplace activities, either individually or in groups, workplaces benefit by having the task completed and by giving people an opportunity to learn.

While experienced experts exist in almost all but the newest fields of endeavour, they are not always available. In Phil’s case, the necessary expertise rested only with his employer’s competition, an impractical if not impossible alternative source of expertise. In Rob’s case, senior management believed he had the necessary ability to manage the key issues required to bring the turnaround in on time and on budget. For Juan, it was more of a personal challenge. While the necessary expertise could have been found, Juan had always envisioned this as a personal challenge and something that he would do. So it is the workplace, and the inherent challenges that they embody, that provide the rich and often powerful learning experiences
described in Chapter IV. Some of the stories told in Chapter IV occurred several years prior to their telling. This, in itself, demonstrates the powerful impression that these experiences have left on the people interviewed for this research. What classroom could leave such a positive impression?
5.3 Purposefulness: a key enabler

The role of judgement is critical to the learning described thus far. However, judgement, as it has been demonstrated, is not by itself the sole determinant. Judgement is but an integral part of purposefulness, and it is purposefulness that provides the vehicle for the workplace learning described. The role of purposefulness is to provide focus, or rather a refocus, from the goal, which is in the future, to the ambiguity being experienced now. This refocus allows the learner to use Dewey’s three interpretive tools, observation, knowledge, and judgement to both construct meaning and decide on an appropriate action. For example, Rob’s goals of bringing in the turnaround on time and in budget became refocussed on reducing the amount of work that the engineers had allocated. Too much work would have the dual effect of adding time and money to the turnaround’s cost. Purpose allowed Rob to observe, look at the work schedules submitted by all engineers, and use his existing knowledge, including what he had learned from his predecessor, and then make a judgement about the best course of action. In the first instance, he judged it better to try and have the engineers make the decisions about what to remove from their schedules themselves, and sent out an email to that effect. That they initially refused is not important, what is, though, is that they eventually did, proving that his judgement, informed by purpose, was correct. That is, that the best people to decide which work could be removed from the schedule without jeopardising the turnaround, were the engineers. Although a solution in itself, the problem of how to get them to do it was only realised, after the initial judgement was made. Consequently, by refocusing, Rob used purpose to, observe, know and judge. He produced the method used to elicit the required outcome in only two attempts.
5.4 Key Characteristics: A Learning Model

Project planning and management models commonly used in workplaces, such as GANTT and PERT, not only assume, but facilitate, projects (of any size) as linear processes, each one with a clearly defined beginning and end. Though not all of the projects described in the cases above were formally defined as workplace projects, several, such as Rob’s turnaround, Juan’s ear hook machine, Phil’s 3 ½ minutes to knife and Liz’s GSM network, were. While all of these experiences can be described as dynamic, primarily because of the interactions that transpired, they each occurred in what is, indisputably, a linear timeframe, and it is within this linear timeframe that their informal workplace experiences have occurred.

I claim that informal workplace learning occurs within what is the linear timeframe of a project or an individual’s work experiences. Like many of the concurrent or consecutive, activities that occur within these linear events, the informal workplace learning described in the case studies above is a dynamic process that has a beginning and an end. However, unlike the linear process in which it occurs, I also claim that learning emerges from a complex and interactive milieu as the learner interacts with his or her problem and the multi-dimensional environment in which it exists. I develop this next.

5.4.1 An encounter with the unknown

As stated above, informal, workplace-based learning is a dynamic process. It begins when an individual, in his or her journey towards a distant objective, discovers that they have met an impasse, a point in their journey where they are unable to go
forward because they have encountered the unknown, or as Schön (1987: 28) contends, we are surprised, and it is this surprise encounter that causes the learning practitioner to reflect-in-action.

For some, this encounter involves a visceral feeling of discomfort and an emotional response to the situation. Phil, for example, in Case 4, expressed this feeling of frustration when he explained his response to being assigned the task of achieving 3½ minutes to knife as being: “How the hell do I know?” However, in the cases reported above, while the subjects remained aware of their objectives, whether it was achieving 3½ minutes to knife, designing an GSM network, or building an ear-hook machine, a decision, to go on, or to give up, had to be made.

5.4.2 Refocusing from the distant to the present – defining purpose

Having decided to press on, into the unknown, workers become learners by shifting their focus from their distant, final objective, to that of the present. For example: To get her mobile network design completed, Liz had to first learn how to ensure her team had the necessary skills and then how to develop an effective way of sharing information with them. This shift from distant to present creates a need to know, and the circumstances for the creation of what will be, for them, new knowledge. Their purposefulness, therefore, is apparent in learning how to find a way to solve this new and unexpected problem, so that they may return their attention to their objective, which, in Liz’s case, is to design a national mobile phone network with her team of Indonesian engineers. To do this they must first make sense of their situation.
5.4.3 Constructing meanings

To make sense of their situation, learners ask questions such as: What is happening here? Why is it happening? What does it mean? What do I, or other people know, that can help me understand this problem? What other sources of information about this problem are available? And by observing: what is happening, where it is happening, when it is happening, and who or what it is happening to. Through this process, which involves assimilation and accommodation (Section 2.1.4), learners go beyond simple information processing and construct meaning by comparing what they are able to observe (the information they collect) with what they already know (their personal biographies).

This sense-making not only helps the learner understand the problem, it also helps him or her move closer to a solution. However, this process of sense-making cannot continue indefinitely, as learners at work have limited resources and time. The process continues only until the learner is satisfied that they have resolved their present situation by making judgements in actions that move the project forward. This is ‘purposefulness’ expressed in the undertaking of these actions.

5.4.4 Emergence of purpose

I claim, then, that as our learners make sense of their situation new knowledge emerges also allowing a solution to emerge, often, as a single course of action. This is evidenced when Juan solved the problem of the rotation of the feed wire, when Rob solved the problem of how to get his engineering team to cut jobs from their turnaround lists, when Jo decided on a course of action that would help her to understand the various points of view of the Plant Managers and when solving the
problem of how to get their trust, and when Liz solved problem after problem with the management and education of her team of Indonesian engineers.

These particular cases of learning cast doubt on our traditional understandings of judgement and the role it plays in deciding, amongst a range of options, which is best. In these cases, judgement is used, not to determine which option is best but, whether the emerging new knowledge has provided a solution that sufficiently satisfies (satisfices) the needs of the problem, by resolving it in actions. That is: is the emergent solution a worthy enough articulation of the purposefulness of the project?

To illustrate the concept of emergent purpose, I will use the analogy of a jigsaw puzzle. Picture the learner as a jigsaw puzzler, and his or her encounter with the unknown as a blank table top, on which they will assemble their jigsaw. This is no ordinary jigsaw. There is no picture of the completed puzzle to use as a reference and, as yet, no pieces. Pieces to this particular jigsaw are created as the puzzler initially reflects on what they already know (their biography) to create the first pieces. They will then explore their environment, starting with those people and things closest to them, creating yet more pieces. As these pieces are created, those that are similar to what is already known are grouped together and from those, the ones that most closely correspond with what we know, but are, in fact, new pieces of information, are fitted as one would a piece of a jigsaw puzzle, in an act of assimilation. Pieces of the puzzle that represent new information but do not correspond with what is known are put to the side. If this new information seems useful to the puzzler, it will be kept and perhaps later accommodated.
As the puzzler collects more information he or she will create more pieces and add them to the puzzle, fitting them together and building a picture (an understanding) of the problem. Rather than collect all of the pieces, our puzzler only need collect enough to see the possibility of what the picture may be (a wire straightening device, for example) and as the form of the picture clarifies, a solution emerges. Judgement is used:

- Firstly, in accepting or rejecting information through processes of assimilation and accommodation
- Secondly, in determining if the emergent solution is, in fact, viable and will allow the puzzler to move forward, and
- Finally, judgement is used to determine if the process of collecting information should continue or terminate, that is: Is the puzzle solved or are more pieces needed?

Just as in the jigsaw, we do not need to see the whole, but only a part, to see what the whole may be. The simpler the puzzle, the fewer pieces will be needed before a solution that satisfies emerges, and the less complex the judgement-making process will be. Inversely, the more complex the puzzle and the more possibilities it has the potential for, then more pieces will be required before a judgement can be made on whether or not a viable solution has emerged. While there is potential for error, the cases presented above show that if the learner is able to exercise practical judgement when integrating their existing knowledge with their observations, then their judgement will result in efficacious purposeful action.
5.4.5 Emergent and purposeful action – the creation of new knowledge

Purposeful action, a product of practical judgement, is the experiencing of resolving problems. By experiencing, I mean that our actions are able, at best, to resolve the problem or, at worst, to bring us closer to a solution. New knowledge is the product of this purposeful action, whether it has produced the desired results or not. This new knowledge is either used to feed forward, allowing the learner to continue towards her or his objective, or having failed to solve it, to feed back into the problem-solving process, forcing the learner to reconsider the situation and develop a new solution to try. In this cycle, practical judgement is exercised again, purposeful action taken and new knowledge produced. Knowledge will always be the product of purposeful action. Regardless of the outcome of our purposeful actions, knowledge will have been acquired. What I mean here is: if the outcome is positive, the worth of the new knowledge will have been proven empirically, however, if it is not, its value (worth) is that it does not work, at least in this particular situation.

With a successful solution the worker as learner has added both value to the workplace activity and new knowledge and experience to his or her personal biography. As a consequence of this experience and the change to biography, the learner has also changed. While this may often be subtle and perhaps undetectable, in some, Jo for example, the change is less subtle, manifesting itself as a more confident Jo, someone who feels as though she could “…tackle any isolation procedure now…”.

In each of the case studies explored above, we are able to read how each encounter with the unknown was able to add to the learner’s biography, and consequently,
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change the learner. While Jo is most adamant that she would be able to repeat her success with the LOTO procedure anywhere, we can also see that Rob, Phil, Liz, Juan and Chris have all had experiences that have left them more confident and competent. Even Rob, who struggled with his encounter with the new Capex procedure, would be able to approach his next Capex with a significantly enhanced understanding of the process. What makes this type of learning both life-changing and valuable is that it is both authentic and practical. That is, the learning has occurred in authentic workplace environments, involving the solving of real, rather than simulated, problems. For both their current and future employers, these experiences provide real and tangible examples of how each of the subjects of this research has been able to solve crucial workplace problems, acquire valuable knowledge, and go on to successfully complete this or her projects.

As the literature review discussed (Ryle (1949), Polanyi (1966), Stevenson (1991), Cohen and Manion (1994), Nonaka and Takeuchi (1995), Billett (2001a)), there are two broad types of knowledge, propositional and procedural. This bifurcated view of knowledge is somewhat perplexing in that it can assume (wrongly) that one type of knowledge, propositional, is used for thinking and the other, procedural, for doing. The impression is that people who do, only use knowledge related to the ‘doing’, that is procedural knowledge. This bifurcation is particularly evident in the divisions between the vocational and university sectors of education. While it is clear that some knowledge appears to be of a purely propositional type, for example, the names of places, people and things, another view, and one that I share as an adult educator, is that knowledge must, if it is to have value in the workplace, be capable of being put to use. That is, what differentiates knowledge from information and
data: what gives it substance and value, is its ability to be used productively. In this context, anything else should be regarded as noise, that is, irrelevant, information and data (non knowledge), that has the capacity to interfere with, or at worst, block, our quest for solutions to our problems (or answers to our questions).

To illuminate this idea, I offer the following example. To know that a particular type of thing is called a motor vehicle, that one make of motor vehicle is Holden and that one model of the Holden range is called a Commodore is all propositional knowledge. To then use that knowledge, when deciding on which motor vehicle to buy, for example, to correctly identify a Holden Commodore as one amongst many different makes and models of motor vehicle, then that knowledge becomes procedural. Therefore, whether knowledge is either procedural or propositional is not inherent in the “knowledge” itself but in its use. In other words, procedural, or propositional, are, not so much varieties of knowledge, but rather, perspectives on its use, and to use such knowledge purposefully and productively adds value to what we do, as I have shown in this thesis through the fieldwork.

Knowledge defined as a ‘justified true belief’ is also problematic, particularly once the process of justification is scrutinised. My claim here is that it is the method of justification that will determine if something is to be considered knowledge, or not. Drawing on my previous claim, that, at least in the workplace, knowledge must add value to the work that we do, and that what gives knowledge its value, is its ability to be used productively, then our method of justification must, therefore, be one that demonstrates its productive use. Consequently, legitimate workplace knowledge, is a true belief that has been justified through empirical testing, and proving, that is: its
utility, in the field of work. Therefore it would also be reasonable to claim that knowledge is contextual, that is, what might be considered justifiable in one context, may not be justifiable at all in another. It is through ‘knowing’ that ‘knowledge’ is contextualised.

Secondly, to know, and to understand, have different meanings. Based on our previous discussion of knowledge, we have recognised two broad types, knowing that (propositional knowledge), and knowing how (procedural knowledge). From this discussion we determined that propositional knowledge is concerned with facts, propositions and concepts etc., whilst procedural knowledge relates to tasks and skills. My claim here is that whilst knowing that and knowing how cannot be, and should not be devalued as critical components of our appreciation of knowledge, understanding or, knowing why, is just as critical and that, without it, our concept of knowledge is left less than whole. For example, Juan could not have overcome his problems with the ear hook machine as effectively as he did without ‘understanding’ the nature of the problems that he was confronted with, nor could Liz have made the decisions that she did regarding the best approach to managing the people in her team without some significant understanding of the cultural dynamic that she was experiencing.

Dewey (1938: 69) defines knowledge, as a component of purpose, as:

Knowledge of what has happened in similar situations in the past, a knowledge obtained partly by recollection and partly from information, advice, and warning of those who have had a wider experience.
Though broad, this definition seems, upon reflection, to be in fact, too narrow as it assumes that only knowledge of similar, previous, situations is of value. However, as we can see through Liz (and others) our biography, our whole life history, contains knowledge, that while not always derived from, or related to, similar experiences, is still of value, perhaps critical value, in novel situations. It is the sum of our accumulated knowledge, our whole life history, which lays an interpretive foundation for all of our present and future experiences, shaping the way we perceive our environment, the events that occur in it and our responses to them.

In summary, informal work-based learning occurs when learners construct meanings organically and holistically, until a resolution emerges. Once satisfied that they have a workable solution – not necessarily an ideal solution, but one the worker as learner is satisfied will, should or could, work – then it resolves the problem, and learning occurs. This allows the learner to progress, both intellectually, that is, they have learned something valuable about their situation, and practically, that is, what they have learned has enabled them to progress, allowing them to resolve their initial disjuncture and go on.

This work-based learning involves five distinct though integrated processes:

1. An encounter with the unknown;
2. Refocusing from the distant to the present – defining purpose;
3. Constructing meaning;
4. Emergence of a solution; and finally,
5. Purposeful action: the creation of new knowledge.
In engaging with this process, the work-based informal learner, in the course of his or her normal work, encounters the unknown. This encounter causes forward motion towards their objective to stall, and this stalling creates purpose. Purpose arises in the temporary shifting of focus from the long term, to the immediate. To make sense of this unknown situation the learner constructs meaning by scanning the environment for information about it, asks others, seeks out information from other sources, such as texts, and draws on their own life experiences. From this process a resolution emerges. Learning occurs, and new knowledge is created, when we make judgements and observe their effects on the problem. In these instances knowledge is a product of acting, and, rather like the solution emerging from our constructed understanding of the problem, knowledge emerges through acting on the problem. This new knowledge, potentially, has significant value for both the learner and the organisation in which he or she works. To the learner it has provided added experience and capability, which may transfer to other similar problems in the future. To the employer it represents value by enabling the learner to progress towards a solution and eventually complete a project that is significant to the organisation, for example, achieving 3½ minutes to knife, designing a national GSM network, or implementing a standardised LOTO procedure. The justification of this new knowledge comes through its practical application and the value it brings to both the learner and the workplace.
5.5 An epistemology of practicality

Based on the evidence presented in this research, I make the claim that practical rationality and its holistic, context-dependent approach is far more effective in dealing with novel situations than is rule-based, technical rationality. In several of the situations described in the cases above, it has been the capacity of the practitioners studied to set aside conventional, technically rational, and perhaps, safe approaches to problem-solving, and adopt the somewhat riskier, yet highly effective, and practical approaches exemplified in Liz’s novel (and, to some, high risk) approach to managing the people in her team. Other examples include Rob’s equally risky, yet highly successful strategy, for managing his project engineers and their budgets, and Jo’s equally successful strategy of initially dealing with the Plant Managers individually, then teaming-up with a ‘broker’ that eventually led to the acceptance of the uniform, site-wide, LOTO procedure by all of the Plant Managers.

While rule-following has its place (and the LOTO procedure itself, is an example of this) there are clearly times when convention does not apply. Liz, for example, could have easily applied Western management approaches, and insisted that people be punctual, Jo could have stuck with the more conventional strategy of asserting her ‘authority’ as the site’s Occupational Health and Safety Systems Specialist, as could Rob, as the Turnaround Manager. But, each one chose unconventional, yet successful, approaches to solving their problems.

Rule-following, as exemplified in technical rationality, binds the practitioner to a specific set of problem-solving conventions, therefore limiting not only the inputs to the problem-solving process, but also limiting the outputs, that is, the solutions.
These forms of bounded rationality will, of course, often produce an outcome that satisfies the practitioner’s needs. However, by limiting outcomes, technical rationality also limits our ability to innovate. Consequently, when a novel situation requires a novel solution, such as Liz’s problem with her design team, the rules of technical rationality must be put aside allowing the practitioner to find a solution unique to the situation.
5.6 Where to next?

We now know more about workplace learning, specifically that:

a. workplace learning can and does add value to both individuals and the workplace,

b. purpose and purposeful action play a key role in the solving of workplace problems and what we learn while doing so, and that

c. this type of learning has identifiable characteristics.

However, there are still questions left to answer. For example, this study does not tell us if this learning is transferable to new yet similar work situations, nor how adults ‘own’ learning. There is still much to understand about the cognitive and constructive processes that produced the knowledge and facilitated the making of the judgements that enabled the subjects of this study to ‘go on’. I raise three potential areas, which should advance an ‘epistemology of practicality’.

**Transferability:** The knowledge and skills acquired by the subjects of this study were done so in a highly specific learning environment. How transferable is knowledge learned in such a highly specific context? How different do contexts have to be before purposes are radically diverse?

**False and worthless learning:** Jarvis (2006: 3) expressed concern that it is possible to learn the wrong things. That is, learning something that is false, or not valuable. Each of the subjects studied could have observed, known and judged, to produce outcomes that failed to lead them through to a satisfactory conclusion. In section 5.4
A Learning Model, the learning process identified from this research is described. Can these characteristics be found through other studies of workplace learning, and if so, can they be safeguarded from falsehoods?

**Self-Directed or Goal-Directed learning:** As I stated in Section 2.3.12, I prefer that the learning studied in this dissertation be regarded as goal-directed, rather than self-directed. While much has been written on self-directed learning, perhaps best characterised by Hase and Kenyon’s (2000) heutagogy, I make this preference based on my current appreciation of the two being different. That is, that the self-directed learner is literally, self-directed by interest and want, which are not always ‘practical’. The goal-directed learners described in this study are, by contrast, driven by what are entirely practical motives: the need to solve a problem directly related to their work and perhaps intrinsically also to their identity, or at least their workplace or professional identity, rather than a sense of selfhood per se.

Further study in this field would serve to determine if there is indeed a differentiation between the two, and specifically, if it is goal-directed learning that produces more valuable knowledge and the most efficacious results. If this is the case, then practitioners and facilitators of self-directed learners, might be better served to adopt goals, rather than pursue a subject because of its relationship to an interest or problem. So both a workplace-based explanation of what is both intrinsically ‘worthwhile’ as well as ‘self-directed’ would be interesting, to see how purposefulness plays out in this wider way.
5.7 And finally

In Section 2.0, I made the claim that:

A significant problem for people in VET, who are working with industry, is that everyone ‘knows’ what learning is about. We have all been to school, and these educational experiences have shaped our perceptions of what learning at work will involve. Simply put, the common perception is that learning (or training) requires time away from work so that learners can sit in a classroom and be told by a teacher (trainer) what they need to know.

This thesis has clearly demonstrated that learning is something that occurs, not only outside of the classroom, but outside of traditional learning contexts, and that the workplace is a rich source of learning opportunities. It has also clearly demonstrated that learning is not entirely dependent upon social interaction, but can, and does, occur in individuals working and learning independently of others. The central tenet here is that suitably equipped individuals, when confronted with novel situations, and the inherent problems residing within them, can and do solve these problems, and in the process generate new and valuable knowledge. I have also demonstrated that the directing force behind this type of learning is not so much the ‘self’ but the need to solve a specific problem, a road block per se, and therefore enable the learner to continue on towards his or her goal. Just as importantly, this research has clearly demonstrated that learning, rather than being separated from work, can and is, intrinsically a part of it.
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Appendix A – Plain Language Statement

Plain Language Statement

Dear Research Participant,

I am a University of Melbourne student undertaking studies towards a Doctor of Education in the Department of Education Policy and Management in the Faculty of Education. As discussed with you previously this project involves an investigation into the creation of new knowledge in the workplace and the role that “practical judgement” plays in the creation of this new knowledge.

You have been asked to participate in this study because your past and/or current work experiences indicate that you should be able to contribute to the case studies and consequently to my understanding of the phenomenon described above. If you should choose to participate in this study I would like to assure you that your participation is voluntary and that you may withdraw at any time and that if you do so, you may also withdraw any unprocessed data previously supplied.

This research will be based on case studies that will be developed over time through interviews conducted with you at a time and place of your choosing. All interviews will be audio recorded digitally and stored in a password protected folder on this researchers personal computer, or alternatively, on a password protected removable memory stick. Transcripts of these interviews will be stored in an identical manner. Copies of transcripts will be returned to you for verification before inclusion in any product of this research.

As the number of study participants will be quite small (no more than 10) I anticipate that it may have implications with regard to your privacy or anonymity. To ensure your anonymity, and that of your organisation, all data will be de-identified and you and your organisation will be referred to by a pseudonym in any publication arising from this research. However, while every reasonable effort will be made to protect data supplied by you the confidentiality of data provided is subject to legal limitations (eg. Subpoena or freedom of information claim). With your permission I would like to retain all approved interview materials so that they may be used in future related projects.

If you should have any concerns about the conduct of this research project you should contact the Executive Officer, Human Research Ethics, The University of Melbourne, ph: 8344 2073; fax 9347 6739. Contact details for the researcher and co-supervisors are provided below.

Yours sincerely,

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Appendix B – Research Interview Pro forma

Research Interview Pro forma

Overview
This process will not involve a “classic” question and answer interview, rather my approach will involve the facilitated telling of stories. My role will be to engage with informants to facilitate the telling of their stories and to draw on incidents of interest (cases) and then to focus and clarify based on the following approach.

Process
Informant preparation: To familiarise informants with the purpose of the interview, each one will be briefed on their involvement in this research project. This will include an explanation of their role and the context of the research.

Define the context in which the problem presented itself: I will ask the informant to recall a situation in which they were or may still be involved that placed them in “unfamiliar territory”. I am seeking to place the “knowledge creating event” in context so I will encourage the story teller to paint a broad picture of the project and its overall purpose for the individual, organisation and/or business unit.

Probing and clarifying: I will then direct the informant to focus on one specific problem or situation. Time will be spent probing and clarifying phenomena of interest. This process may take several interviews.

Understanding the problem: Using probing questions I will develop a deep understanding of the problem and its importance to the situation. I need to be sure that the solving of this problem was in fact critical to the process moving forward. In other words, any other solution should have halted the project’s progression or resulted in a failed or unsatisfactory project outcome. My assumption here is that both successful and unsuccessful outcomes can help in my understanding of knowledge creation and the role that practical judgement plays in it.

Discover/understand the used: At this stage I want the storyteller to describe in detail the process used to solve the problem. During this process probing and clarifying questions will be used, some examples are:
- Was this a familiar problem or something completely novel?
- How was the problem framed?
- Was reframing considered?
- If it was how was reframing actualised?
- If it was reframed, why was it?
- Did this reframing help to understand the problem and provide previously untried alternative solutions?
- Was the problem broken down?
- How was the problem broken down into its constituent parts?
- Was a root cause analysis or some other form of problem solving method used?
- Were a number of possible solutions canvassed?
- Were outside agencies (people other than the storyteller) consulted, if so who, in what capacity, and did they supply the solution in whole or in part?
By identifying and understanding the problem solving method(s) I should be able to determine if it was “practical judgement” and not just luck that was at the core of the problem solving, and consequently, the generation of new knowledge.

Identify and describe the “practical judgement” that resulted in the choice of solution: Once I have the problem and the problem solving process fully exposed I should be in a position to identify the point at which “practical judgment” was applied. Now I can ask why that specific solution was chosen, why not another, perhaps equally viable solution. How was the selection of this solution justified?

This should then produce a discussion about the choosing of the solution and why the informant believed it to be the “best” solution to this problem. This should also identify the “new knowledge”. How did organisational culture and or expectations (its norms and dominant logic) affect the solution selection process?
Appendix C – Sample of Audio Transcription

Case 4: Phil and 3½ minutes to knife

*Phil:* When I first joined this organisation there was a company set-up to build the plasterboard business throughout South East Asia. At that stage the plan was to build up to five plasterboard plants throughout the region. I got heavily involved in all of those but in particular one in China and another in Indonesia and consequently spent some time in China. At that stage I was a Product Development Team Manager and we were given questions related to the specifications of the plant design and capability, for example:

- Could we use this type of calcination equipment to make our plaster?
- If so what are the good and bad points about that?
- Could we run the line such that it was 3½ minutes from mixing to knife?

All very nice questions, but the problem I was immediately confronted with was, how the hell do I know? There’s no text book on this stuff and no way of predicting it theoretically, you have to go and work out ways to experimentally verify that you can actually achieve these targets.

Let’s talk about the time to knife. Time to knife of 3½ minutes is, for example, half the time we have here at this plant. It certainly was the shortest time that any of our plants had ever run and it really dictated the size of the plant. If we had come back and said that no, it had to be 5 minutes, then the length of the plant would have had to have been 3½ times longer, so it would have a fairly significant impact on capital. The first thing we did was to understand what happens here at this plant.

We off here by understanding what the time to knife here was, what the setting characteristics were, what controlled those setting characteristics and what variables we had to play with to reduce that time. We typically run between 6 and 8 minutes to knife so we were looking for about half what our time was here. We basically began by understanding this site, understanding what variables we had and the next step was that we developed laboratory scale tests or procedures to mimic that and once were confident that we could make a change in our own plant and mimic those changes in our test procedures we were happy then to explore and to see what we could do to achieve even shorter set-times. This involved us learning how to mix properly in the lab. The procedures that were around really bore no resemblance to real life. We had to learn how to make some of the additives additions, when you add them a difference and it took us some time to develop those techniques to a level that we could confidently predict a change here and therefore felt confident that we could predict a change on a faster plant. We then had to complete a fairly extensive test program and write it all up to confirm that it was in fact possible. Based on our work they built the plant with a 3½ minute time to knife.

I was lucky enough to go over there and see the plant commissioned and absolutely everything we observed and predicted happened in real life, both good and bad, it wasn’t all fun and skittles. That plant was commissioned and ran on our recommendations. To me the pleasing thing was that we were able to extrapolate our knowledge learned on this site to Shanghai.
Informal learning at Work: The Art of Learning by Doing

Researcher: You say that a 3½ minute time to knife had never been done in this company before? That the knowledge to do this did not exist within this company and you had to create that knowledge?

Phil: I had to convince myself first, before I could convince anyone else that it was possible. I admit I was a little nervous when they first said that we’ve got to have a 3½ minute time to knife. I said, well how do we measure that, given that you’ve got a different process conditions, different plaster in particular. We had really no way of predicting that in the beginning?

Researcher: So what was the first thing that you needed to do?

Phil: Understand. Understand the process, understand the variables we had to play with, understand the potential range of conditions that we had to work with. It’s not a case of just getting the setting time. We had to achieve a good paper bond and a whole host of criteria that we had to meet and it wasn’t easy to do that.

Researcher: So the paper actually bonds to the plaster?

Phil: Yep.

Researcher: And you were concerned that under the new conditions that you might not get that bond?

Phil: Yeah. If I went out in to the plant here at the moment and I played around with some of the setting parameters, I could stop the bond and even though the plaster core would set hard the paper would just peel away. So you have to make sure you understand all of the requirements and make sure you’re still achieving those even though you are changing some of the other parameters.

Researcher: So what role does the paper play?

Phil: In plasterboard, paper actually provides you with up to 90% of your strength.

Researcher: So of course if you’re not going to bond the plaster to the paper you’re in trouble, aren’t you, so you had to take several steps back, go back to the basics and develop a process from there.

Phil: Yep.

Researcher: So you get to a point where you are confronted with a number of different options. Was it all trial and error or did you make judgements based on your knowledge that led you through a process.

Phil: As I said, I’m a person who needs to understand, we went back to the basics of how this plant ran and I tried to get some understanding of what was important, why did this place work? Once I understood why this place worked, I could then say okay, these are the things I need to make any plasterboard plant work. So therefore we then went to mimic all of those things in the lab and when we got a match to all of those parameters with this plant, I then started to change a few things to see if we
could still achieve all of those parameters but with a shorter set time. As often happens, when you change one thing you affect three and this is where I think a lot of people make a mistake, the change one thing expecting one thing to happen. You’ll change three because they haven’t got the understanding that if I change that, I also need to change that to still make it work in the same way.

Researcher: So you knew in advance that if you changed one thing you had to compensate somewhere else.

Phil: Or that I may have to and we’ve done that by running our lab experiments versus the conditions we run on our plant. So we then said, okay here are the normal conditions that we run on our plant, here’s our lab conditions that run the same way, what happens when I do this? Make a change and make an observation.

Researcher: Did you get an opportunity to try these out on the plant?

Phil: Some we did, yes.

Researcher: Was there much resistance to that?

Phil: Yes.

Researcher: How did you overcome that?

Phil: That was a matter of demonstrating what we’d done. Saying we understand the risks and running these changes for only a few minutes to minimise the impact on people. And clearly things that were going to put the plant at risk or people at risk, we just didn’t do. We accepted that we couldn’t do that on the plant. The things we did, we could vary the setting times, we could play little games out there quite easily, just to verify what we’d done in the lab and once we’d gotten a certain distance down the track we then said okay, let’s switch over to the plaster that was going to be used in China and learn about that plaster, because it was very different and came from a synthetic gypsum source rather than a natural gypsum source. So that was one change we made, we left everything else as it was.

Researcher: So you actually made up a plaster that would be used in China?

Phil: We actually got plaster made by the company who were going to supply the calcine equipment in Germany. They sent us back a hundred kilos and we played with that to understand it, because it had some fairly unique properties because of its particle shape. So based on the knowledge that we had on our own system we then started to disturb it, if you like, by firstly putting the new plaster in and understanding what that change did. Then we started to play games using a set of new baseline conditions to see what we could and couldn’t do and ultimately to shorten our time down to 3½ minutes and it worked and worked well.

Researcher: And it’s still working?

Phil: Yep! That plant’s not in China anymore though. It was relocated to Korea. Korea had an undersupply so they packed the whole thing up and shipped it across
the water. Be that a good decision or not they are now talking about building another plant in Shanghai.

To me, the way I look at this is we understood the system, we understood the process.

*Researcher:* But to do that you actually studied your own plant first.

*Phil:* Oh yeah.

*Researcher:* That’s interesting, you realised that you really didn’t understand your own system as well as you needed to?

*Phil:* Well that was the very first question I asked. How do I do this? And no one came to me with a book of instructions. No one had ever done it before, they had sort of built plants that were pretty much clones of one another because we know how that one works so let’s build one the same. This one, because its calcination technique and its gypsum source were quite different so every one was a little bit more nervous.

*Researcher:* There’s risk involved in developing a new procedure, isn’t there?

*Phil:* Oh Yeah. If we had stuffed up and said you could run a plant to $3\frac{1}{2}$ minutes and in fact you couldn’t it would have involved huge expense. They would have had to literally extend the building, literally extend the line.

*Researcher:* So the end design of that particular production line depended entirely on you findings?

*Phil:* Yep. The distance of that line was about 200 metres long. You’re looking at adding an extra 100 to 150 metres to the length of the line and building and everything that goes along with it. We didn’t own the land to do that we would have had to buy extra land. It may have in fact influenced the location.

*Researcher:* So what actually determined the time to knife was it the fact that the company had bought a block of land that was limiting the size of the factory?

*Phil:* Really its capital cost. Other companies, other places have run those sorts of times but that’s right on the edge and like many industries, one company doesn’t like telling the other one what its doing even though they’re probably doing the same thing. We know that there are other plants that run around about 3 to $3\frac{1}{2}$ minutes is the fastest I’ve heard.

*Researcher:* Now interestingly you’re a chemist, right?

*Phil:* Yep.

*Researcher:* Why didn’t you just go straight to the lab, what made you go out into the factory?
Phil: There is no way you can predict this sort of thing theoretically, no way.

Researcher: No computer models, no mathematical models, nothing?

Phil: No. There’s just too many variables. In my previous job we were working on 3 dimensional computer models using Cray computers and things like that and I know what they can do and can’t do. There’s just no way that there’s the time and money available, or that it’s warranted to do that sort of thing for the plasterboard industry. You have to get out there and you have to do it.

Researcher: So it was actually cheaper and more practical to go out and do a real workplace study?

Phil: Yep. If you try to model it you’ve got to do the work anyway to verify your model so you’re paying for a model which you’ll use once or twice in your working career probably. It’s just not worth it when at the end of the day people wanted to see that we had paper bond, people wanted to see that we could get it to set in 3½ minutes.

Researcher: They wanted tangible proof?

Phil: Yep.

Researcher: A computer model wouldn’t have cut it?

Phil: Not in an industry like this. We were able to photograph and photocopy our test pieces as a means of storing information and you could see that you had achieved paper bond at certain times and things like that. In terms of anyone in this company knowing how to do it in this company when I first arrived, they just didn’t. Funnily enough in talking to people since then, as I’ve got to know more and more people throughout the company, there’s little snippets every now and then, when people say, oh yeah, that’s right we knew that, we knew this. It pulled together a lot of knowledge that was in certain individuals heads but wasn’t ever collected together.

Researcher: Is it collected together now?

Phil: Yeah, there are reports around what we did.

Researcher: So if you needed to repeat what you did, you could go to the report and use that to do it again.

Phil: Yeah, we actually did, we looked at least 5 plants and did similar type studies but having the basic understanding of what was going on, it was easy. It didn’t frighten me, it didn’t frighten us at all because we understood what was going on we understood what variables were important, what outcomes were important, what variables we had to play with, could we do it or not, effectively put it into our physical model, if you like, and give it a go.