Performance at work: Identifying the smart workforce

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Performance at work: Identifying smart work practice

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A compelling reason to understand the skill requirements of contemporary work practice is to determine how best to develop these skills. To paraphrase Glaser (1990), unless we understand clearly what is required for performance it is difficult to organise instruction to secure that performance. Moreover, it seems at this time there is a growing gap between the requirements of emerging and contemporary work practice and the ability of educational institutions and educational provisions to meet these requirements. Therefore, in order to identify the measures to be adopted in educational provisions for both preparing and enhancing further the ability to perform in the workplace, it is necessary to understand more fully those requirements. Taking up this theme, this chapter proposes bases for understanding what constitutes work practice. This is achieved through identifying dimensions of workplace activity and their demands for performance. It is proposed that smartness is defined in different ways in particular workplaces. Hence, contextual and situational factors are central to accounts of performance at work. A framework comprising dimensions of work practice is used to identify common aspects of work and their variables to determine how they are manifested in particular workplaces. These dimensions of work practice go beyond identifying 'technical skills' and work organisation to include the ways individuals engage in work required to be variously flexible, adaptable or, conversely, highly consistent given the particular requirement of the work practice. The chapter concludes with views about how these skills can be best developed.

1. Introduction: a scenario

Both day and night, the secondary processing plant is visible from the nearby highway. During the day, the tower-like structures which house the shaft kilns and the loading ramps set it apart from the other buildings on the site and those nearby. At night, festoons of lights illuminate the plant making it highly visible. The plant's kilns and furnaces operate twenty-four hours a day every day of the year. Such a large and imposing set of buildings might be thought to require far more workers than are actually employed there. In all, the plant comprises an administration block, and the fusion, calcination, laboratory and control room work areas. Each of these areas has small teams of four to six employees working in rotational shifts, largely, without any formal supervision. These teams enjoy wide discretion with their work tasks. They discuss, make and enact decisions about their work. There are few work demarcations at this plant. Employees with recognised trade skills engage in activities outside their trade area, even undertaking tasks that in other workplaces might be restricted to a trades assistant. Equally, employees without trade recognition will sometimes undertake tasks that in other work places could only be undertaken by tradeworkers. Decisions are made and understandings developed by these teams about when it is necessary for particular tasks to be undertaken and by whom. The workers decide when they have meal breaks and whether all or part of the shift takes breaks together. During these breaks, discussions are often work-related, shift tasks discussed and decisions made. Also, employees have access to equipment that permits communication with other workers and other work teams or to monitor activities occurring elsewhere in the plant. Morale is generally high in the work teams. Levels of absenteeism are low, often known about in advance and accommodated by the work team. The plant's product is value-added and almost universally bound for export. Consequently, the plant has been endorsed as meeting international quality standards for the processing and monitoring of its product. This workplace, with its 'green field' industrial arrangements, flexible work practice and team

work, exemplifies much of what was aimed to be achieved through workplace reforms of the late 1980s and early 1990s.

Although not always quite as glossy as just portrayed, the work practice at the plant characterises much of what is often proposed in accounts of the smart workforce. The employees work in small, self-directed high morale teams that are both independent from each other and yet interdependent. Most of the teams enjoy high levels of discretion in their daily tasks. Moreover, there are few artificial demarcations to inhibit the wide use of their skills. Many workers are multi-skilled, having specific trade skills and also expertise in their particular work area. From this account it is possible to outline some common attributes required for skilled performance in this workplace. These include worker discretion, team interactions and decision-making. However, within these common attributes are variations in the requirements for each work area that reveal complexities and complications, that render unsatisfactory easy prescriptions, such as those just made above. For example, the control room workers do not enjoy the same level of discretion as those in the other work teams. The plant's engineering staff, who have technical supervisory roles and responsibilities, monitor the work of the control room. Some of the control room workers find this frustrating. They talk about having a 'feel for the plant'; a sense of knowing about it and how best to control the flow of product[1]. The engineering staff's directions sometimes contradict what the control room workers believe to be the best response for the particular processing situation. Also, for these workers, the camaraderie in the work groups is inhibited by the intensity of their work and the need to constantly monitor the plant. Hence, they have to rotate through meal and rest breaks, thereby missing opportunities for the group discussion enjoyed by other teams. The workers in this area also require rich understandings of the plant's entire operation and an ability to interrogate the control equipment in order to monitor and manage the plant. In addition, they require the ability to use the multiple-levels of screens of the computer terminals to monitor, identify and respond to changes in the qualities of the ore being processed. These work requirements set them apart from other workers in the plant. There are also other ways in which the requirements for work performance are not uniform across the plant. For instance, in the laboratory, the metallurgist has a professional standing that sets her apart from her co-workers, who are essentially subordinates. Performance here focuses upon faithful adherence to, and consistency and precision with set testing procedures. Hence, as well as a hierarchy in the work team, opportunities for the workers to exercise autonomy are limited except in the execution of precision and care with routine procedures. Therefore, although in each area of the plant many of the qualities commonly advanced as characteristic of what is means to be a smart worker are evident, there are variations in these attributes that require further identification and clarification.

Moreover, what happens in this workplace in terms of the organisation and execution of work is far from typical. In the open cut coal mines a couple of hundred kilometres to the west of this plant, adherence to demarcations, industrial agreements and historical practices associated with the constant wagering over the 'dash for the cash' are part of what it means to be an expert coal miner. In these mines there are also specific considerations about safety and the need to use effectively and maintain heavy equipment that are quite different than those in the secondary processing plant. Consequently, uniform prescriptions of smart workforces appear inadequate because what it means to be smart will be determined by the requirements of practices within particular workplaces. This is likely to be the case even when the same vocational activity is being conducted in different settings. Differences in the goals, work practice, services, division of labour and culture of practice are likely to be in some ways unique to each workplace, thereby setting each work practice apart from others (Billett 1996). Consequently, what is considered to be a 'smart' workforce is influenced by situational factors. Indeed, it is these that make each workplace and, hence, its work practices unique.

[1] These workers stated how they developed a feel for the plant and could sense how best it should work. They also spoke about returning from holiday to find the plant a different one than when they left it and having to adjust their feel for the plant. These observations should not be lightly dismissed. In a study of skilled workers (Billett 1997), midwife and painter both reported similar senses of knowing about their work.

Therefore, to understand what comprises a smart workforce it is necessary to understand the particular characteristics of each work practice and what knowledge underpins performance at work. Such an understanding may permit the development of instruction best able to respond to these requirements. Consequently, the aim here is to propose a framework comprising dimensions of work practice that can be used to delineate the requirements of work practice for each work situation. This is clearly an ambitious undertaking and claims to be universally applicable are likely to be easily tested. However, such a framework may offer greater promise than seeking to identify sets of generic qualities of a smart workforce.

The means adopted to identify dimensions of workplace performance are through an evaluation of recent literature. This task requires a discussion of the contributions of different bodies of literature, in order to provide a basis for considering trends in contemporary work practice. This discussion commences with an overview of the recent literature on the changing nature of work practice and its implication for performance at work. Next, contributions from three different sets of literature about identifying work performance are discussed. These are: (i) the generic competency skills view, (ii) the cognitive perspective, and (iii) the socio-cultural perspective. Respectively, these literatures inform about the potential for some uniform and universal dimensions of capabilities; the importance of domain specific knowledge for performance, and the social and cultural contributions to expert performance. Following this, a framework comprising dimensions of work practice is advanced which draws upon and reconciles the contributions from the literature. However, initially some of the characteristics required of current and emerging smart workforce are identified.

2. Changing bases for understanding work practice

The changing nature of work practice and what is required for performance at work has been the subject of research in a number of fields. These changes can be categorised under: (i) changes in the kinds of work to be undertaken; (ii) requirements for work performance; and (iii) engagement with the workplace or work situation. These three categorises of changes are now discussed in overview.

2.1 Changes in work

There are ongoing changes in the kinds of work in which individuals are likely to be engage. Often, this change is seen as that required to produce high value-added goods, a shift towards service industries, and an ability to work with high technology support systems (Applebaum 1993, Barley & Batt 1995). There is also the claim of movement from an ‘industrial society’, predominantly concentrating on the manufacture of goods and products, to an ‘information society’ which adds value by turning information into knowledge and services. There are also claims about changes in the kinds of work being undertaken. Forecasts consistently indicate a massive reduction in the demand for ‘semi-skilled’ and ‘unskilled’ work and a consequent increase in the future demand for management, professional and administrative staff (Noon & Blyton 1997). The significance of these trends is to question earlier research (e.g. Braverman 1974) that suggested the de-skilling of workers and removal of their discretion was likely to be a feature of such innovations. However, recent research (Berryman 1993) suggests that the shift to post-industrial forms of work require workers to be flexible, adaptable and have a depth of understanding about their work that sets them apart from their predecessors. That is, the evidence suggests the shift is towards types of work that are more demanding, requiring higher levels of performance and, therefore require, a more exacting preparation. These changes not only influenced the kinds of work to be done, but also how individuals work; the concerns of the next two sections.

2.2 Requirements for performance

The requirements for performance in workplaces appear to be characterised increasingly by change and difference. A number of studies describe contemporary work practice as having both complex workplace organisational and work tasks dimensions. Consequently, the knowledge required for performance at

work is held to be becoming more rather than less demanding. Bailey (1993) refers to accelerated production cycles, a proliferation of products, heightened levels of uncertainty and changing work practices. The intensification of work practice as a result of greater competition also increases the demands of work practice (Noon & Blyton 1997). Consider, for instance, the intensification of nurses' work. Within hospitals, patients are now having shorter stays than in previous times, as they are recuperating at home or elsewhere. Consequently, most patients in a hospital ward are likely to now require high levels of care. Hence, nurses' work has been made far more intense. In the banking sector, computerisation has brought about a reduction in routinised activity, thereby also making this work more intensive (Bertrand & Noyelle 1989). Hence, for nurses, bank workers and others, work has come to include the management of more intense activities. As a consequence, higher levels of non-routine activities and increased accountability may be required. However, this change is unlikely to be uniform, with the intensity of work varying across and within workplaces. Consider the intense periods of activity in hospitality work during times of service, compared with more measured preparation time. In other workplaces, emerging performance demands might be associated with higher quality standards, a smaller workforce and wider range of tasks required of 'multi-skilled' workers. So, a dimension of emerging work practice is its intensification requiring the ability to monitor and prioritise which activities demands non-routine and creative thinking rather than merely deploying standardised procedures. Also the need to possess a wider range of capabilities and apply that knowledge across a broader range of tasks is required.

Despite views to the contrary, the use of some technology can also make performance at work more rather than less demanding. While technological tools may ease some tasks and undertake them with greater efficiency, there are demands associated with these tools. For instance, Martin and Scribner's (1991) study of CNC lathes operators found these workers require high levels of conceptual and symbolic knowledge. Taking the work task from the blueprint through to digitally organising the lathe's work requires conceptual and symbolic knowledge to transform the activity and realise the product. The increased use of technology in work applications renders invisible the knowledge required for and to understand its operation. Consequently this knowledge is more difficult to learn and deploy because its accessibility is reduced. These procedures are more demanding when workers are required to be more broadly skilled, because developing conceptual knowledge takes time and effort.

Changes in the organisation of work are also transforming work practice. For example, less hierarchical approaches to work organisation (e.g. self-managed teams, 'green field' work sites) are held to be becoming more common, as are innovations in technology and the demands of responsiveness and flexibility in the production of goods and services (Wall & Jackson 1995). There are also enhanced demands arising from team-based forms of work and working in flat organisational structures. Principally, increased levels of interpersonal skills and decision-making are required to be effective in these kinds of work environments (Berryman 1993). However, it is premature to view these changes as being universal shifts in patterns of work and the means by which work has to be undertaken. For instance, small enterprises (particularly those managed by owners) are unlikely to fit into simple patterns of transformation found in larger enterprises (Kempenich, Butler & Billett 1999). In other circumstances, these transformations will be patterned differently according to the requirements of the particular workplace or work situation. Taking another instance, the armed forces and emergency services will likely want to maintain a 'command culture' which is 'top down' and hierarchical, rather than one that aims to be open and democratic.

2.3 Engagement with work

How individuals engage with work is also transforming and becoming increasingly diverse. The changing nature of work is held to now require a synergy between the interests of employers and employees (Davis 1995). Those enterprises characterised as 'high involvement' are said to be shifting power away from management toward a focus that capitalises on workers' expertise to secure productivity and efficiency gains. In doing so, the aim is to secure the workers' enthusiasm and commitment to the enterprises' goals.

Given these circumstances, Howard (1995) claims that enterprises and workers have never needed each other more. Such relationships, Carnevale states, requires the removal of 'top-down' hierarchies and their replacement by approaches to work organisation which "drive autonomy, skill resources and new flexible technologies down the line towards the point of production, service delivery and interface with the customer" (1995: 239). Analogous characteristics are those identified by Rowden (1995; 1997). He claims American small to medium sized enterprises which have endured over time and remained viable are characterised by: (i) having a unique market niche supported by the development and maintenance of the worforce's skills, knowledge and attitude; (ii) integrating employees into the enterprises' work practice; and (iii) enhancing the quality of working life.

Questioning some of these assertions, Forrester, Payne and Ward (1995) note the peripheral and precarious status of many workers particularly those in the service sector. This is because, associated with all this change, is a shift in patterns of engagement with work being involuntarily contracted, and with part-time and home-based work becoming increasingly common (Noon & Bylton 1997). Engagement for these workers is characterised by changing patterns of participation (e.g. part-time work, split shifts, home-based employment) which may inhibit levels of skilfulness as these workers become peripheral. Much of the part-time work is involuntary (Lipsig-Mumme 1996). Certainly, for many in the workforce, what was previously accepted about career paths and permanent employment are now disappearing as are ideas about mutual trust and the rewards for hard work well done (Kepenich, Butler & Billett 1999). Also, many public sector workplaces remain hierarchical and top-down and are unequivocally held to be responsive not to client needs but to executive government. What all this suggests is that there are likely to be complications and contradictions in the trends mentioned above, as these changes are by no means uniform (Waterhouse 1998).

From this review, it seems that factors such as the intensification of work, the opaqueness of knowledge required, an enhanced need for communication, decision-making and team work are emerging as key components of work practice. The human resource development literature suggests that the survival of enterprises and their prospects for development in a changing and competitive environment are associated with developing in employees' the knowledge required for performance. However, these requirements are not uniform across workplaces. Therefore, rather than providing a universal model of emerging workpractice, these changes make it complicated and diverse. Consequently, it is necessary to synthesise a set of dimensions of activities and engagements that can capture this diversity and complexity. Through this synthesis, a framework that informs about work practice in particular enterprises is advanced. To develop the bases for this framework, contributions from other literature are now discussed. These contributions comprise those of three perspectives of the knowledge required for performance at work.

3. Views about performance at work

In this section, an unfolding view of understanding the requirements for performance at work is presented through a review of the contributions of are the generic skill approach, cognitive and context-based views of expertise. Alone, none of these perspectives can furnish a comprehensive view about work performance, however collectively they have much to offer.

3.1 Generic skills perspective

The demand for the knowledge learnt in schooling to more readily transfer to the workplace was instrumental in developing the generic competency or skill approach. The goal of this approach is to identify generic, highly transferable competencies to be learnt by students in compulsory education which would transfer to the workplace. The means for identifying these competencies is usually through employer surveys of requirements for their workplace. In America, the Secretary of Labor's Commission on Achieving Necessary Skills (SCANS) identified skills and competencies held to be generic in so far as they are required for most jobs, yet are separable from technical knowledge likely to be vocational or workplace specific (Stasz 1997). The SCANS competencies include 'foundation skills' comprising reading, writing and arithmetic, thinking skills (reasoning, problem-solving), personal qualities

(responsibility, self-esteem) and 'work competencies' (resources, interpersonal, information, systems, and technology) (SCANS 1992). This view proposes that technical skills are somehow separable from these generic competencies. In Australia, the Mayer Committee (1992) identified seven key competencies (Collecting, analysing and organising information; Expressing ideas and information; Planning and organising activities; Working with others and in teams; Using mathematical ideas and techniques; Solving Problems; Using Technology). These key competencies were intended to be those, which if learnt by students, would transfer to the workplace. The use of these competencies in both countries are primarily focussed on compulsory education and refer to skills to be learnt that are transferable to workplace settings. However, unlike in an employment-linked vocational program, where these key skills can be at least be tailored or contextualised to the vocational practice being learnt, in non-vocationally linked programs in compulsory education this is may not be possible, rendering even more difficult the prospect of their applicability in the workplace.

Stasz (1997) evaluated elements of the SCANS competencies (problem solving, teamwork, communication, personal qualities) identified by employers as being necessary for work performance. In her analyses, she identified different manifestations of these generic competencies across a number of work practices (e.g. transport, traffic management, manufacturing and health care) (see Table 1). The application of these competencies across four examples of work practice indicate that such measures are not so much 'generic' as common to these workplaces. However, this commonality was only when disembedded from the work practice itself. That is, these competencies require embedding in particular contexts to be understood and appraised. The finer grained or more embedded competencies that Stasz (1997) identified are themselves likely to vary in emphasis and meaning when applied to other work contexts. The distinction between generic and common, but disembedded, is important in understanding the knowledge required for performance at work. Generic knowledge would be that which could be transferred and applied regardless of context. So, for instance, being able to work in teams or solve problems regardless of context. This view proposes generalisable forms of knowledge permit performance in any situation. Hence, once an individual acquired the competence of team work or problem solving, they would be equally effective in working in teams in all situations (e.g. traffic management, health care, crewing a commercial jet) or solving problems in circumstances as diverse as icing a cake through to mining coal. This claim is overly optimistic to say the least, except at the most general level. Perkins and Salomon (1989), and Evans (1991) challenge the existence of competencies robust enough to be transferable across diverse domains of knowledge, other than at the very general level (e.g. think before you act, found out what clients want). However, what is important about Stasz's work is the identification of the differing manifestations of these competencies in different types of work practice. She found common requirements across a number of work practices can only be understood by identifying what they mean in the particular context.

Table 1 depicts how the competencies Stasz (1997) identified vary across different work contexts. In the left column are the generic competencies, in the centre column the variations in what that competency means in different work context. In the right hand column, characteristics of the version of the competency embedded in a particular activity is presented. So in the three areas investigated, quite distinct variations in these common skills were identified.

Table 1 - Embedding competencies in workpractice (from Stasz 1997)

Competency	Variations	Characteristics
Problem-solving	Trouble shooting	Identifying and fixing problems
	Situation assessment	Gathering and interpreting information
	Quality assurance and control	Surveying for discrepancies
Teamwork	Autonomous/self-managing	Performing work within a definable social system
	Distributed knowledge	Differences in the knowledge and status of team members
	Independent work	Autonomy to operate independently in performing

		team activity
Dispositions	Task/organisation	Formal job characteristics
	Community of Practice	Norms, values and attitudes about work
	Quality standards	Assuming responsibility and liability
Communications	Audience	Groups/individuals being communicated with
	Purpose	Appropriate communication of fact accurately
	Style	Friendliness
	Mode	Appropriateness of language

The common, but differentiated nature of key competencies has been identified elsewhere. For example, Billett (1993) examined the nature of skilled work using the Mayer key competencies (and two other measures). Table 2 depicts differences in the frequencies these competencies were reported being used 'most of the time' in four categories of work ('unskilled', non-trade skilled, trade, professional). Subjects from each category were able to identify aspects of their work that related to these competencies. Yet, these competencies were used with different frequencies across the categories of work. Significantly, one important commonly reported attribute was to respond to novel situations (new tasks or problems). This ability, which requires individuals to have higher orders of knowledge, was evident across all categories of work. So while the other attributes were common across all categories of work, it was the ability to use knowledge in novel ways that was most consistent. However, higher orders of procedures require context-specific knowledge to be applicable. That is, richly embedded knowledge is required for these procedures to be enacted. This table indicates that the ability to transfer is not restricted to professionals and para-professionals. It is a requirement for all categories of work. However, although there are common factors across these categories of workers, the data indicates difference. Note, for instance, the levels of responses in 'working with others and in teams' across the four categories of workers. Much is made of the need to work in teams in the literature reviewed earlier. Yet, consider the differences in the data between 'unskilled and 'professional'. Taking the examples of the process workers mentioned earlier and, for instance, a dentist working with dental technicians. It is possible to suggest that not only are the 'team' interactions likely to differ, but so is the concept of teams. The differences are likely to be premised on the nature of the occupation (its procedures, goals, mores) and the context of its application. For example, dental surgeons working with peers in an operating theatre are likely to engage in team situation of a different kind than that when working with their own dental assistants.

Other analyses of generic competencies in hospitality settings (Stevenson 1996) and with airline counter workers (Beven 1997) found that 'generic' aspects of work practice such as communication, problem-solving, use of technology, and numeracy had few applications which could be described as generic. Instead, while there were identifiable commonly labelled competencies across these workplaces, their meaning was quite situational. Hence, these key competencies can only be understood when they are embedded in a particular workplace circumstance, thereby challenging the idea that they are widely transferable. Even the apparently universally applicable knowledge associated with maths and language use was found to be situational.

Table 2- Mayer Competencies: Activities performed `most of the time' by work category

	'Unskilled'	Non-trade Skilled	Trade	Professional
Collecting, analysing and organising information	51%	64%	55%	75%
Expressing ideas & information	32%	57%	48%	58%
Planning and organising activities	34%	55%	52%	83%

Working with others & in teams	81%	78%	73%	50%
Using mathematical ideas and techniques	20%	29%	23%	33%
Solving problems	39%	53%	52%	75%
Using technology	49%	42%	44%	58%
Routine Tasks	81%	69%	57%	42%
Novel situations	22%	20.6%	20.5%	23%

Therefore, prescriptions for workplace performance advanced as generic competencies are likely to be most useful in helping to identify attributes that may be common across workplaces, rather than themselves being generic. Yet, even these common prescriptions are disembedded and can only be understood within the context of a particular workplace or work situation. That is, only when they are embedded in particular situations will they have meaning.

3.2 The Cognitive perspective

The cognitive literature provides useful accounts of the knowledge required for workplace performance. Indeed, much of the work within cognitive science over the last thirty years has focused on understanding what comprises expertise (smartness) in order to consider how best to develop this attribute. This literature holds that the efficacy of experts' work is partially through their ability to categorise these tasks by their means of solution. The breadth and organisation of experts' knowledge permits this categorisation (Gott 1989). Their rich repertoire of experiences provides the ability to view and categorise tasks by solutions. This permits engagement with workplace tasks in ways quite different from those of novices who simply lack this knowledge (Charness 1989), and may respond only to the task's surface features (Sweller 1989). For instance, a mechanic might be able to diagnose a mechanical problem by listening to the noise of the engine and categorise the problem as being a major or minor fault. A novice would not have the ability to diagnose from the engine noise. The solution-based categorisation of tasks by experts is also assisted by active monitoring, involving testing and refining selected responses to a problem which is simply unavailable to novices (Alexander & Judy, 1988). The rich repertoire of domain-specific experiences furnishes understandings that permit monitoring and informs experts of whether the tasks are being completed as anticipated. This monitoring also permits the progressive evaluation of responses to problems, and promotes evaluation of alternative strategies for securing solutions (Glaser 1990). Consequently, the expert mechanic works on the engine and monitors what happens to confirm or the diagnosis. Judgements about the difficulty of the particular task, how to apportion time, assess progress and predict outcomes of the task as it progresses are also enabled by monitoring and categorisation (Chi, Glaser & Rees 1982).

Moreover, because of their rich domain-specific knowledge bases, experts are also able to apply cognitive processes seemingly instantaneously thereby accomplished routine tasks apparently automatically (Ericsson & Simon 1984). Previous compilation and chunking of domain-specific knowledge secured through extensive experience reduces the cognitive load thereby freeing up the working memory to concentrate on unfamiliar components of their tasks. The breadth and organisation of their domain-specific knowledge, also permit experts to close gaps in the available information, consistently producing more useful solutions than novices and are also more efficient with their search for solution options (Anderson 1982). Further, as a product of extensive experiences within a domain of activity, experts' knowledge have become 'de-bugged' (Glaser 1990, Gott 1989), permitting quicker access to the knowledge required for both routine (regular) and non-routine (new) tasks in the workplace. It seems that when faced with non-routine problems, novices fare worse than experts because of experts' ability to deploy a systematic and conscious solution search (Glaser 1990). So according to this literature the organisation of individuals' knowledge associated with the domain of activity is that which permits expert performance at work.

Reference to knowledge within this literature encompasses conceptual and procedural representations of knowledge and their dispositional underpinning. It is these representations of knowledge that individuals hold in memory and deploy when thinking and acting in the workplace. In particular ways, this knowledge furnishes the basis for performance within a domain of knowledge (e.g. an occupation or vocation). Comprising facts, information, assertions, concepts and propositions, propositional knowledge is differentiated by levels of stateable facts or concepts of increasing complexity (Evans, 1991). It ranges from simple factual knowledge through to deeper or more complex levels of conceptual knowledge (such as understanding about workings of complex systems, such as a piece of equipment whose operating basis is hidden). Depth of understanding is premised upon the strength of relationships amongst concepts (Groen & Patel 1988), thereby emphasising its interconnectedness and causal relationships. That is, deep understanding is based on linkages, associations and an appreciation of the causal links in those associations. Procedural knowledge (Anderson 1982) comprises techniques and skills. Whenever we are thinking or acting we are deploying procedures. In reading this text you are applying a set of procedures that are associated with word and letter recognition (specific procedures) as well as procedures which are monitoring and interrogating the text. Consequently, to delineate its functions, procedural knowledge has been further classified into levels or orders to understand the different roles that procedures play. Stevenson (1991) proposes three levels of orders. First order or specific procedures are employed to achieve specific goals (curling hair, turning screws with a screw driver, changing gears in a car). Being specific only to routine tasks, specific procedures are not effective when non-routine or ill-defined tasks are encountered. When monitoring, evaluation and strategy selection are required the second-order procedures are invoked. This order includes breaking the task up into a series of sub-goals so the individual can achieve the task. Third or higher-order procedural knowledge manage the first and second orders, by acting executively on them, and by switching between orders, when necessary.

The realisation that procedures are deployed in ways not observable has been used to dispense with earlier views that separated cognitive from psychomotor activities. Indeed, propositional and procedural forms of knowledge are interdependent. Propositional knowledge cannot be engaged without enacting procedures (see Table 3). Procedures are unlikely to be deployed without goals. Further enmeshing these types of knowledge are their dispositional underpinnings, comprising attitudes, values, affect, interests and identities (Prawat, 1989). Perkins et al. (1993a, 1993b) view dispositions as individuals' tendencies to put their capabilities into action. For example, they determine how individuals' conceptualise tasks and the values they place on the deployment of procedures as well as whether they engage in effortful activity or not.

To illustrate the application of these kinds of knowledge, Table 3 furnishes the responses from workers in the secondary processing plant described in the opening vignette. They were asked what it meant to be an expert in their workplace (Billett 1993). In the left-hand column are their aggregated responses with the three columns to its right indicating approximations of their propositional, procedural and dispositional components of these measures of performance. In the Propositional column, a determination of whether the response involves factual (F) or deep understanding (D) is advanced. In the Procedural column reference is made to whether specific (S) or higher order (HO) procedures are required. In the Dispositional column a distinction is advanced about whether the response is indicative of organisation [workplaces] (O) or personal values (P).

Table 3 - Cognitive structures required for performance in a secondary processing plant

Elements of performance	Propositional	Procedural	Dispositions
Knowledge of work	F - D	S - HO	O
Experienced	F	S - HO	O
Competence/ability	F - D	S - HO	O P
Minimum breakdowns	D	S - HO	O P
Planning/organisation	F - D	S - HO	O P
Control costs and budget	F - D	S - HO	O P
Effective communication / Inter-personal skills	F - D	S	O P
Training others	F - D	S - HO	O P
Predicting and minimising problems	D	HO	O P
Leadership / management / supervision skills	F - D	S - HO	O P

Problem-solving	F - D	S -HO	O P
Flexibility / multi-skilled	D	HO	O
Currency of knowledge	F	S	O
Decision-making	F - D	S - HO	O P
Time management	F	S - HO	P
Liaison / co-ordination / consultation monitoring/ gathering information	F - D	S - HO	O P
Common-sense	F	S - HO	O P
Meeting demands - expectations	F - D	S - HO	O P
Stress management,	F	S	P
Analytical, thinking skills basic literacy and numeracy	F	S	P
report writing	F	S - HO	O P
Dedication	F	S	P
Interest			P
Safety conscious	F - D	S - HO	O P
Presentation	F	S	O P
Working without supervision	F - D	S - HO	O P
Pride in work			P
Resourceful /initiative/ trustworthy	F - D	S H	P
Professionalism			P
Work as part of a team	F - D	S	P
Self-esteem/identity			P
Self-evaluation	F - D	S - HO	P
Knowing when you're wrong'	F - D	S - HO	P
Thoroughness/ attention to detail	D	HO	P
Consistency	D	HO	P
Adaptable/ receptive to change	F- D	S -HO	P
Quality of product/ service	F - D	S- HO	O P

So the cognitive perspective identifies the breadth and organisation of experts' domain-specific knowledge required to perform non-routine (new) tasks as well as completing routine tasks almost unconsciously. Experts' organisation of knowledge around salient domain-based principles is held to maximise the prospect for problem solving and transfer (Groen & Patel 1988). It is the existence and organisation of their knowledge rather than their ability to process that knowledge that sets experts apart from novices (Sweller 1989). Therefore, this discipline holds that the ability to perform smartly is premised on having domain-specific knowledge comprising both factual and deep conceptual knowledge, specific and higher order procedures underpinned by the values and attitudes required for performance at work. In particular, deep conceptual and higher order procedures permit performance with new tasks and allow transfer to other circumstances such as new work tasks. Indeed, a hallmark is the ability to resolve non-routine (novel) problems within a particular domain of knowledge. Yet, these characteristics are not universally applicable. Instead, these attributes are held to reside within specific domains of knowledge associated with particular areas of performance.

The goals for performance in each enterprise are likely to differ because what passes as domain-specific knowledge in one setting may not correspond with what is required in another. For example, in a study of four hairdressing salons (Billett 1995) it was shown that what it meant to be an expert differed across the salons. In a trendy inner-city salon, giving contemporary and fashionable cuts and colours, conversing about style and a holding a particular set of values was all-important. In another salon, set in low socio-economic area, managing difficult customers who made strong demands and were prone to complain quite vociferously and forcefully was a hallmark of expertise. In a third salon, set in a provincial centre that had endured years of a rural recession and drought, expertise was in being able to maintain the clientele. This included balancing the hairdressers' need to secure additional treatments from clients with the risk of losing their clientele. In a fourth salon, in a town in United Kingdom, being an expert required being familiar with the personal histories and backgrounds of the elderly clients who came for weekly treatments. In varying degrees and in different ways there was a requirement for the hairdressers to be a

friend, confidant and with elderly clients, a key social contact. Moreover, there were identified differences in the work practices in each workplace, despite there sharing the same vocational practice -- hairdressing. Put plainly, this means that the domain of knowledge required for performance at work, may not be the same for another, even when the same vocational activity is enacted. Therefore, it is necessary to reconcile the cognitive perspective with sociocultural theory that furnishes an understanding about situations and circumstances.

3.3 The Sociocultural perspective

In advancing a sociocultural view of expertise, Scribner (1988 cited in Berryman 1993) emphasises contextual factors and contributions to thinking and acting. She claimed that expert performance is characterised by flexibility in modes of solutions to identical problems, creative shortcuts to simplify and economise on mental and physical effort, finely tuned to the environment, and effective use of setting-specific knowledge. This is exemplified in the hairdressing study just referred to above. Therefore, domains of knowledge required for expertise have to be viewed as situational, being related to the circumstances of their deployment. Expertise is fashioned within particular domains of activities (social practice) thus embedding it in social circumstances. Lave and Wenger (1991) refer to full participation in a community of practice, rather than expertise. Their concept of full participation is that all practitioners are peripheral because the work practice itself is evolving. They refer to a pathway to full participation in the community. Hence, access to, and participation in, the community's (workplaces) activities are sources of understanding. Full participation implies being capable with new activities, performing new tasks and comprehending new understandings, which is analogous to and reconcilable with the cognitive view. This suggests that an embedded view of domain-specific knowledge is required to understand the performance requirements of particular workplaces.

The particular workplace's range of variables, mean that they will have unique qualities that will determine what constitutes expert responses to particular problems (Billett 1995). Even the most apparently standardised work activities will likely have unique variables. For instance, the clientele and composition of staff in the particular fast food chain or bank branch will render the task of working in and managing that work practice are in some ways unique. Expertise is embedded, being the product of practice over time and with understanding shaped by participation in the activities and norms of that practice. It includes pertinence in the appropriateness of problem solutions, such as knowing what behaviours are acceptable, and in what circumstances. This quality reflects the values a community of practice (a workplace) assigns to problems and the appropriate amount of effort and understanding of what knowledge it privileges. Moreover, in the same workplace, there may be a number of communities of workplace practice. For instance, in the secondary processing plant referred to earlier there are different work areas which have their own norms, goals and values. As illustrated earlier, there are differences in the goals and discretion across the plant and some instances of those differences were evident in the comparison between the control room and laboratory. To take another example, the quality, use and means of interactions are quite different in the administration area than elsewhere. Those differences include the means of communication, the formality involved and the characteristics of language. Quite different behaviour is observable in this setting than in other areas of the plant. In sum, this view emphasises rich association between setting and expertise – what is required to be smart. In all, developing an understanding of the variables, goals and mechanism for success are likely to result from extended participation in the workplace.

When the contributions of the three perspectives outlined above provide a basis to understand further the requirements for a skilled workforce. What has been advanced is that there are likely to be attributes that are common across all types of works. However, what comprises performance with these attributes can only be understood when they are embedded in the requirements of particular workpractice.

4. Planes and dimensions of workpractice and performance

This section takes what has been discussed above to advance a tentative framework for understanding what constitutes a smart workforce for individual workplaces. This framework also includes the occupational practice that (mechanics, hairdressing, mining, nursing) occurs in the workplace, they are

not separable from it. This framework has three planes. Firstly, it depicts dimensions of workpractice and work performance. This is achieved by drawing on contributions from the earlier sections outlining the requirements for contemporary and emerging work practices and the generic knowledge perspective. Secondly, these dimensions of workpractice are notionally linked to particular types of knowledge required to be enacted (see Table 4). Thirdly, these dimensions of workpractice and performance, and hence the knowledge required for their performance are embedded in a particular work and vocational practice. That is, these dimensions and knowledge types can only be understood through reference to the tasks, values and interactions that comprise the activity system of a workplace. These dimensions, which are in some cases overlap and are interdependent are identified in Table 4 as being eightfold. They are: (i) routineness; (ii) discretion; (iii) intensity (iv) complexity; (v) opaqueness; (vi) interactions (vii) homogeneity; and (viii) engagement. In the central column are dimensions of workpractice drawn from the earlier discussions. Each dimension comprises a common attribute and indications of the range of variables within dimension is then made. It is proposed that these common attributes are deployed in various ways and degrees in different work practice. The outside columns acknowledge the dispositional, procedural and conceptual basis for each of these dimensions. However, these columns are only notional. They do not detail the kinds of knowledge required in each dimension as this will only be identifiable when these attributes are understood in a particular context.

D	P	C	**Table 4 - Dimensions of Work practice within Vocational Practice**	C	P	D
			Routineness			
			The degree that the workpractice demands the workers engage in non-routine activities.			
			Non-routine activities — *Routine activity activities*			
			Discretion			
			Degree by which employee is permitted to use their discretion.			
			High discretion activities — *Low discretion activities*			
			Intensity of activities			
			Degree by which the task can become highly intense.			
			High intensity activities — *Low intensity activities*			
			Complexity			
			Number of variables compounding task completion			
			Tasks with multiple variables — *Tasks with discernible variables*			
			Hidden knowledge			
			Degree by which the understanding of work tasks remains difficult because the knowledge is remote or opaque thereby being hard to learn, hard to reach and hard to make accessible			
			Task components hidden — *Task components accessible*			
			Interactions			
			Qualities of communication			
			Qualities of working alone or as a team			
			High communication demands (what about qualities) — *Low communication demands*			
			High interaction with team members(interdependence) — *Low interaction with team members* (independence)			
			Homogeneity of tasks			
			The degree to which the workplace tasks are the same or different than each other			
			Nature of homogeneity — Nature of heterodoxy			
			Engagement with workplace			
			Dimensions of engagement - full time- part-time - isolated-team member – physically or geographically separated			
			Part-time, Shift, Physically located, Geographically situated — *Full-time, Day hours, Physically isolated, Geographically isolated*			

4.1 Routineness

The degree that work practice demands workers engage in either routine or non-routine activities will determine the requirement for the possession of higher order procedures and deep conceptual knowledge in the domain of vocational activity. Take for example, motor mechanics. In some workshops, such as major city dealerships, the work will largely involve routine servicing on the same make of vehicle. In another workshop, the mechanic will be faced with a range of different kinds of vehicles and types of mechanical tasks from maintenance work, through to repairs that requires fabrication of components and engineering tasks. The greater the demand of non-routine activity, the higher the demand for domain-specific procedures and concepts as well as the deployment of higher order procedures to maximise transfer. In addition, particular dispositions are likely to be needed to engage in the kinds of transfer required for non-routine activities. The more the demands of routine performance, the greater likelihood that specific, but potential highly accountable work activity has to be undertaken. In sum, there are likely to be variations in the routineness of activities in workplaces. If it possible to identify the range of routine and likely non-routine tasks, then the focus for development of the knowledge required in the workplace can be tightly focussed. As illustrated in Table 3, it seems mistaken to believe that only particular categories of workers engage in activities that require higher orders of knowledge.

4.2 Discretion

The discretion of workers is determined by the culture of the particular workplace and, in particular, its division of labour. If permitted only limited discretion, workers are unlikely to be required to deploy a broad range of attributes associated with decision-making. High discretion workers are more likely to be engaged in making decisions, requiring deeper and higher forms of knowledge than those subject to close supervision. For example, high discretion workers may set their own goals, periods of work and means of achieving those goals. Hence, they are enmeshed in a greater diversity of decision-making and problem-solving than those not permitted wide discretion. For instance, at the secondary processing plant those in the fusion areas had very wide discretion in their work, which included the timing of starting furnaces to co-ordinate access to less expensive night-time electricity and changing of the costly electrodes that were imported for the plant. The workers in the control room, however, felt frustrated and disempowered by the removal of some of their discretion. Moreover, in the hairdressing salons, discretion was quite varied. For instance, in two salons the owner/managers refused even highly experienced and long-serving staff discretion with accessing and ordering stores. Yet, in another, this was the task for the apprentice. So the division of labour determined the array of discretionary tasks and decision-making. In sum, the breadth of work tasks will determine not only the knowledge required for the broader range of tasks but also the decision-making and dispositions which underpin their use. If the scope of likely decision-making can be identified and the knowledge associated with the breadth of decision-making then, again, the requirements for performance can be more clearly understood.

4.3 Intensity

The intensity of activities represents another dimension of emerging and contemporary work practice. Although there has always been intense periods in work activities (e.g. the hotel kitchen and restaurant during service periods) as was discussed earlier, work in many situations is becoming more intense as workforce size is reduced, work loads increase and competition enhanced. To work intensely may require an ability to plan ahead and prepare in order to manage the workload. It is likely also to require the ability to prioritise and to deploy strategies to best manage the different demands of the workload, to delegate or stage activities in order to balance the intensity of the workload. Hence, in the restaurant and kitchen, preparatory work is done ahead of the service period to avoid doing this work at the busy time. Judgements have to be

made of what kinds and quantity of preparation are likely to be required. The hairdresser may attempt to avoid booking treatments that will take time and space during a busy period. During those periods they will monitor their time and even deploy waiting strategies (e.g. sit clients at the wash basin) to best manage the workload. However, even prior planning will not always suffice. Hence, the ability to manage multiple tasks simultaneously is necessary for expert performance. Again, the demands of intensity are likely to vary and, again, to manage intense workloads requires higher and specific orders of procedures and dispositions that comprise both personal and organisational values. The identification of the demand for intense work can serve to assist understanding the kinds of demands required for the particular workplace role.

4.4 Complexity

Determining what comprises complexity of a work task is slippery. It is not useful to consider complexity in terms of difficulty, because what is difficult for one individual may not be so for another. The notion of routineness gets around this particular problem. However, some tasks require the resolution of a greater number of compounding variables than others. Consequently, the number of variables that have to be negotiated in task completion forms another dimension of work practice. For instance, planning for an evening's service in a restaurant may have more or less variables depending on the range of dishes offered in the menu. The tasks of dressing the hair of a wedding party, where the same style is required regardless of the suitability of the style for all members of the party and to meet a particular deadline presses the hairdresser to consider a range of variables. The design and construction of a piece of equipment, item of clothing or building requires the individual to consider a range of variables in producing either the plan or the manufactured article. Again, the need to balance a range of compounding variables demands the need of higher orders of procedures and deep conceptual understanding within a domain of vocational practice. Therefore, an understanding of the array of variables likely to complicate decision-making and task completion will assist with delineating the range of knowledge required for performance.

4.5 Hidden knowledge

Arising from the increased use of technology is a concern about the opaqueness of knowledge to be learnt (e.g. Martin & Scribner 1991). That is, some knowledge is not readily accessible through observation because it is hidden. It requires being transformed to a symbolic medium to be understood. Hence, this knowledge it is not always easy to learn about, develop or deploy. Individuals will not just stumble upon this knowledge, it requires explicit teaching (Billett, 1996). Moreover, the symbolic representations being abstracted from something not visible or tangible are likely to be constructed by individuals in idiosyncratic ways, thereby making it more difficult to achieve common understanding. Beyond technology, there are other circumstances where hidden knowledge makes work practice demanding. For instance, the hairdressers' understanding of the structure of the hair that they shape through chemical or heat treatment is premised on conceptual or symbolic rather than an observable basis for decision-making. The factors of forces and stress that engineers use are also hidden, as is the stitch formation of a sewing machine, the process that leads to the thickening of the chef's sauce and the processes that lead to the accumulation of bacteria in food preparation. At the secondary processing plant, many of the processes are unobservable because they are hidden within kilns, pipes and furnaces. Consequently, like electricians, these workers have to develop symbolic representations to assist them conduct their work tasks. Therefore, the degree by which the work task has elements that are hidden or opaque will also determine the requirement for developing rich understandings. Deep conceptual knowledge is likely to be associated with robust symbolic knowledge.

4.6 Interactions

The requirement for interactions with others and tools in work tasks also varies across work tasks. So, whereas in hierarchically organised work environments interactions with others might be oral and directive, in other situations it might be mediated by technology or realised through negotiation. Therefore, more than variables associated with means of interactions are the norms and cultures in which communication takes place; its discourse. This will vary from the 'command culture' of defence and police forces to the negotiations of a self-managed team or work-based decision-making process. Other variables are the differences in the ways that individuals engage in work and the communication demands of these circumstances. Hence, the maintenance of work teams is required to be now associated with interpersonal skills as well as technical skills. Indeed, the needs for and qualities of team work are mentioned frequently in accounts of emerging work practice. Such considerations are associated with the division of labour in workplaces and, in particular, the shift to work teams (Carnevale 1995; Davis 1995; Howard 1995; Wall & Jackson 1995). Consequently, the bases for interactions required in a particular workplace setting will determine the need to interact with other, negotiate, and communicate. Team work will have quite different meanings in particular situations. Workers who are producing manufactured goods may well be focused on uniformity of product and its adherence to quality or performance standards. Hence, team efforts might be focussed on achieving high production targets and low levels of seconds. In the underground mine, team work extends to a reliance and dependency on team members in a task that is inherently dangerous. In a marketing team, discordance and difference are likely to be valued in achieving a novel product. So these different manifestations of teams may demand quite different combinations of adherence to set standards, common associations or divergence. Because team performance is seen as being distributed across other workers and tools (Resnick, Pontecorno & Saljo, 1997), a clear understanding of the nature of the interactions with others and tools is required.

4.7 Homogeneity of activities

The degree by which tasks are homogenous in a workplace is another dimension of work practice. For example, if all the activities are the same, the speciality is shared and support and guidance to conduct the activity is likely to be more accessible. However, if all the activities are distinct then each task and its relationship to others are likely to be more demanding. Contrast, for instance, the role between a technical teacher working in a large metropolitan college with twenty colleagues who teach related content with that of the teacher in the small provincial college who is the lone specialist in the field. The demands of teaching across courses and administrative tasks set the work apart from that in the metropolitan college. Local government provides another exemplar of organisations that have very diverse responsibilities with individuals often comprising the sole expertise. Compare these circumstances with the workplace where large numbers of individuals are undertaking essentially the same task within which some of whom have particular expertise. The store of knowledge and its availability is contrasted with the earlier examples. The homogenous workplace may provide more support and have less discretionary demands than the workplace where the tasks are not uniform. As is discussed below, the level of support and models required to assist the development of knowledge will differ. Access to guidance and models are necessary for formulating understanding and procedures required in workplaces. The level of homogeneity of activities in workplaces will determine to what degree guidance and models have to be provided or are available gratuitously at the workplace.

4.8 Engagement

As noted earlier, the ways individuals engage with the workplace is being transformed. As workers' engagement moves to being more remote through part-time, shift or home-based work or they are physically or geographically isolated then the demands to interact, understand the changing pattern of work practice, makes the work task more confounding. Issues associated with

communication, team work and discretion all emerge as a result of these transformations. The geographically or physically remote or part-time worker has the task of staying in contact and remaining current in ways that are likely to be quite different than some of their colleagues who at the centre and full-time. Also, the way workers engage in work practice influences their discretionary activities. For instance, workers who are isolated or sole specialists may be required to exercise high levels of discretion. Hence, the transformations in workers' engagement in work activities are placing new demands on the requirement for work practice. A consideration of how workers engage in the work practice is likely to be useful in developing appropriate pedagogical responses.

5 Pedagogic implications: Participation, interaction and guidance

In overview, it seems that the development of the kinds of knowledge required for performance in the workplace which the above section has focussed on identifying are likely to be developed through a combination of participation, interaction and guidance.

5.1 Participation

It is now accepted within the constructivist views of learning that there is little difference between doing and learning. Referred to, respectively, as engagement in goal-directed activity or problem solving in sociocultural and cognitive constructivist literature, it is held that in overcoming the impasses in task completion individuals develop their knowledge. From Piaget onwards, within cognitive theory, it is held that in undertaking tasks which are routine we reinforce our existing knowledge, and by engaging in novel activities (non-routine) we are extending what we know through task completion. Moreover, what has been advanced earlier is that the domain-specificity of the knowledge required for performance may not always be easily accessed in an environment that is quite different than the one that the knowledge is to be applied. Hence, to learn much of the knowledge required for performance, which includes the values and goals of the particular workplace, participation in authentic workplace activities is necessary. This participation should be over time (Lave & Wenger 1991) and involve engagement in combinations of routine and non-routine activities (Billett 1996). This participation may be on its own or as part of an integrated curriculum that includes also participation in programs of activities in an educational institution. Certainly, it seems that an integrated approach offers the most potent basis for developing robust (transferable) knowledge (Billett 1993).

5.2 Interaction

Interaction with others and workplace artefacts such as tools are likely to lead to the development of the understanding and skills required for performance. These interactions can be quite indirect such as observation and modelling of tasks performed elsewhere in the workplace. Interaction with the physical environment also provides clue and cues for performance and goals (Billett 1996). The workplace itself often provides rich examples of completed tasks, processes to be modelled and access to semi-completed tasks that reveal much about task completion (Lave 1990). So, through interactions with others, artefacts and the workplace environment much of the knowledge that is distributed across the environment can be accessed (Resnick, Pontecorno & Saljo, 1997).

5.3 Guidance

However, it is unlikely that all the kinds of knowledge identified earlier will be able to be acquired through everyday participation and interaction alone. In particular, it has been shown that knowledge that is hidden and specific procedures often require the assistance of close guidance by a more experienced other. The role of the guide is to model, coach and provide scaffolding (Collins, Brown & Newman 1989), to assist with technique and to make the symbolic

knowledge that is necessary for performance accessible. Guided learning, rather than didactic teaching is likely to place the learners in the position of problem-solving with the guide providing assistance and access to knowledge that is simply unavailable to the learner. It is likely to be through this effortful process that individuals will construct knowledge and begin to organise it in ways that make its subsequent deployment successful.

So together, participation in workplace activities, preferably overtime, interactions with others, the workplace and artefacts along with guidance by more experienced others are likely to lead to the development of knowledge required by individuals to participate smartly in the workplace.

6 Conclusion

As the requirements for performance at work change and become more challenging, it is ever more necessary to have a clear understanding of those requirements. A simple premise has been proposed here. To delineate what constitutes a smart workforce it is necessary to understand that the requirements of work practice are quite situational. Hence, common attribute and cognitive views about expertise needs to be mediated and understood in terms of the requirements of the particular workplace or work situation. Three planes have guided the development of a framework that has presented eight interrelated dimensions of work performance that can be used to identify what constitutes performance in particular work practice. The number of dimensions could be greater or fewer. Contributions from three bodies of literature about performance at work as well as that which furnishes understandings about the shifts in the kinds of employment, the nature of individuals' engagement with work and the requirements for work practice have been used here collaboratively. Together, these literatures provide a basis to build a framework that can be applied to individual work practice in order to understand the requirements of smart work practice. Moreover, the development of the knowledge required for performance at work is likely best developed through participation, interaction and guidance, particularly in the workplace but also through that non-enterprise specific knowledge provide by vocational education programs. Perhaps only through such an consideration of situational factors and their cognitive consequences will it be possible to consider how the knowledge required for performance in particular workplaces can best be understood and acquired.

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