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**Workplace learning:
its potential and limitations¹**

The workplace is now commonly used as a setting for acquiring vocational knowledge. This situated approach to learning offers access to authentic vocational activities and the guidance of more expert others. However, questions about the effectiveness of workplace learning processes need to be addressed. These questions are central to the evaluation and improvement of learning arrangements which aim to develop vocational skills. To address questions about the efficacy of workplace learning, this article draws on the findings of three recent studies of workplace learning conducted in Queensland, Australia. These studies are used to understand further the potential and limitations of these learning arrangements.

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1.INTRODUCTION

Currently, there is a significant reliance on acquiring vocational skills in workplaces. This reliance is exemplified by trade apprenticeships, the internship of novice doctors and the requirement of novice lawyers to work as articulated clerks. The move to shift the development of vocational skills from the settings where those skills are deployed, workplaces, and locate it within educational institutions, is a relatively recent innovation and a process which still continues. For example, recently in Australia, nurse education has been moved from hospital wards to universities. With such shifts have come claims that workplace learning is ad hoc, concrete and pragmatic, although little evidence is offered to substantiate such claims (Resnick, 1987). Indeed, claims about the inadequacy of workplaces as learning environments seem to be based on an earlier view which emphasised the development of domain-general forms of knowledge which are applicable in any context (Bartlett, 1958). The purpose of educational programs was to develop these forms of knowledge, a view which has been challenged through the growing acknowledgment of the social origins and transmission of knowledge (Goodnow, 1990; Pea, 1987). That is, the construction of vocational knowledge is shaped by the social practice in which that knowledge is deployed, and accessed by learners. This suggests that a more specific view of learning and using knowledge needs to be considered.

It is advanced, in this article that in securing the development of skilful vocational knowledge, workplaces offer a range of attributes which provide the learner with access to these forms of knowledge and facilitates its construction and organisation. It is held that there are also factors that may inhibit the efficacy of the workplace as a learning setting. Having commenced with an overview of the current interest in workplace learning, the paper proceeds to provide a brief outline of a social constructivism. Findings from three studies are then synthesised to offer an account of the potential and some limitations of workplace learning. It is concluded that, although workplaces have the potential to provide learners with access to the forms of knowledge required for skilful practice, that unless the inhibiting qualities of workplace learning, are addressed their potential will not be fully secured.

2. LEARNING IN THE WORKPLACE: CURRENT INTEREST

There appear to be four reasons to consider the workplace as a setting for learning vocational knowledge. First, for many industries and enterprises the option of skill development in formal educational settings, is simply unavailable. Publicly-funded vocational education systems lack the expertise and infrastructure to secure the development of vocational skills in a range of industries and enterprises (Billett, 1992a). Second, with the increase in specialisation and complexity of vocational activity (Berryman, 1993), it is evident that the nature of vocational tasks is becoming both more specific and complex. Hence, vocational education provisions which aim to secure vocational knowledge must reflect these emerging demands.

This more specific focus emphasises not only the different forms of knowledge required for skilful work, but also how that knowledge is deployed in particular circumstances. Third, the demand for greater access to skill development processes, brought about by linkages among remuneration, career progression and skill development (Deveson, 1990), has precipitated a search for cost-effective options for the development of vocational skills. For the above reasons, the workplace is currently being favoured as an accessible and effective setting to develop vocational knowledge. The fourth area of interest is within learning theory which now emphasises the construction of knowledge being mediated by social and cultural circumstances in which knowledge is experienced (Lave, 1990; Rogoff, 1990; Scribner, 1985). It is held that in a situated approach to learning, the authenticity of activity and circumstances assist the development of knowledge and its transfer. Consequently, deliberations about the development of vocational knowledge need to acknowledge the workplace as an authentic setting for this development (Scribner, 1992). This article advances an understanding of the potential of workplace learning, and offers guidance for how this approach to learning can be optimised, by stating some limitations which may need to be addressed.

3. CONSTRUCTING KNOWLEDGE: A SOCIO-CULTURAL VIEW

The constructivist view of learning, adopted here, asserts that individuals construct knowledge through an interpretative interaction with the social world they experience. Socio-cultural constructivism contends that knowledge is sourced through individuals' interaction with a socially determined world, in the forms of its culture, communities and practices. This contention is based on two sets of assumptions.

First, the construction of knowledge is mediated by the socio-cultural context of its acquisition, a view particularly emphasised within Vygotskian perspectives (Leontyev, 1981; Rogoff, 1990; Scribner, 1985;1990; Vygotsky, 1978). This view of cognitive development emphasises guidance by social and cultural circumstances. Guidance is seen as being either proximal - the direct interpersonal guidance provided by a more expert other - or indirect forms of guidance, such the social norms and practice or the way physical settings determines practice. The specific social circumstances within which individuals interact, are described as communities of practice (Lave & Wenger, 1991), with their norms and practices of these communities are referred to as the culture of practice (Brown, Collins & Duguid, 1989). Within the constructivist perspective, it is maintained that individuals appropriate knowledge or as Leontyev (1981) suggests - make it their own - which is differentiated from 'internalisation' of knowledge (Goodnow, 1990; Rogoff, in print). Appropriation, therefore, involves an interpretative appraisal and construction of knowledge by individuals, rather than being a faithful representation of externally-derived stimuli.

The second assumption is that the appropriation of knowledge is initially idiosyncratic, being based on the personal histories and epistemologies of individuals (Greeno, 1989; Pea, 1987, Posner, 1982). Therefore individuals' initial representations of knowledge are unlikely to be the same. However, participation in communities of practice, such as workplaces, offer experiences which result in a greater congruity in the construction of knowledge permitting utility in the communities of practice in which that knowledge is to be deployed (Newman, Griffin & Cole, 1989). Therefore, everyday activities of the workplace provide opportunities for knowledge, and its deployment, to be repeatedly appraised thus reinforcing the value and linkages among different forms of knowledge.

It is claimed that all forms of knowledge, with the exception of higher order procedures, are sourced in social practice (Lave & Wenger, 1991). This sourcing includes what forms of knowledge are to be favoured and deployed in particular circumstances. Robust vocational knowledge, is most likely to be accessed and appropriated through engagement in the authentic activities of vocational practice (Brown, Collins & Duguid, 1989) - the workplace. Learning is not restricted to the outcomes of teaching activities or is privileged to particular settings (Lave, 1993), but rather it is viewed as cognitive change with individuals confronting everyday tasks, whether in the home, at work, or at school. Therefore, learning is ubiquitous in everyday activity through changing participation in culturally-designed activities and settings (Lave, 1993:5-6). Participation in authentic vocational activities, the direct and indirect guidance provided by workplace's social practice are likely to develop knowledge which is at least as transferable as knowledge developed in any other setting (Rogoff & Gauvain, 1984), such as a vocational training college.

The efficacy of learning arrangements can be determined by their ability to offer access to the forms of knowledge which underpin complex activity. Two forms of knowledge represented in memory are commonly referred to - *propositional knowledge* (Anderson, 1982) - facts, concepts, information and assertions; and, *procedural knowledge* (Anderson, 1982) - techniques, skills and ability to secure goals. Together these forms of knowledge are referred to as cognitive structures. Cognitive structures are interdependent, with conceptual knowledge organising goals for activities and procedures securing those goals. The depth of conceptual knowledge and a rich array of goal-securing procedures within particular domains of knowledge are characteristic attributes of experts. Underpinning propositions and procedures are dispositions. *Dispositions* are values, attitudes and preference (Prawat, 1989). Dispositional attributes are key determinants of how, and in what ways, individuals think and act, and therefore construct knowledge (Perkins, Jay & Tishman, 1994a; 1994b). The development, organisation and deployment of these forms of knowledge are seen as being interrelated. These cognitive structures provide the

understanding and procedures required for complex vocational performance, which includes the ability to represent knowledge and apply it to new situations, another hallmark of expertise.

In the next section the findings of three studies, which aimed to determine the efficacy of workplace learning, are synthesised to offer an account of the potential and limitations of developing vocational skills in the workplace. The first study, undertaken in the Queensland coal industry (Billett, 1992b), reports workers' perceptions about the development of skills in the workplace. The second study compares outcomes of participation in different forms of skill development across a range of industry sectors (Billett, 1993). The third study provides an evaluation of workplace-based learning arrangements and their outcomes through an detailed investigation of one workplace (Billett, 1994). These studies, which used surveys, interviews and stimulated recall of work-based problems, have identified forms of knowledge that are most likely to be generated through workplace learning experiences as well as the types of experiences that are likely to assist in their development. As such, these studies offer a basis to make claims about the efficacy of workplace learning.

4. POTENTIAL of WORKPLACE LEARNING

The findings of the studies mentioned above report workplace participants accessing purposeful propositional and procedural forms of knowledge as well as dispositions appropriate to vocational practice. The securing of this knowledge is realised through learning experiences that are authentic and guided by other workers (see Table 1). Everyday participation in work tasks offers opportunities for learners to generate tentative solutions to vocational tasks and then attempt to secure those solutions. This process develops increasingly mature approximations of the procedures required to be successful in these tasks, through a process of testing and modifying their approximations. Over-time this activity results in a repertoire of goal-securing procedures. This on-going development is guided by the close or proximal guidance by expert others, who are able to assist with the initial tentative solutions to tasks and offer guidance about the means of securing goals. This guidance also contributes by managing the selection of tasks for learners.

Table 1
Attributes of workplaces as learning environments

Attribute	Consequence
authentic activities	. opportunities to engage in occupational tasks of increasing complexity . opportunities to understand the overall purpose of tasks
expert others	. assistance with initial approximation of task . modelling, coaching and support . sequencing of tasks to assist development of skills

other workers	. indirect guidance (observation and listening . models
engagement in tasks	. active and constructive engagement in learning task

Experts provide the means and goals for achieving task goals, through further practise and access to increasingly complex tasks. This guidance is analogous to the modelling, coaching and scaffolding of the approach to learning referred to as cognitive apprenticeships (see Collins, Brown & Newman, 1989).

More indirect forms of guidance, such as listening to and observation of other workers in the workplace also assist with the conceptualisation and approximations of workplace tasks. Particularly important is the learning pathway of movement from engagement with peripheral to increasingly complex tasks. However, this pathway is more than one which goes from less to more complex activities, it needs to also provide the novice with experiences which develop an understanding of the purpose of the work activities, their outcomes and the standards by which work has to be done, as Lave (1990) has reported. Therefore, initial activities for novices should include experiences which allow the development of an understanding of the work processes in which they are participating. In one of the studies (Billett, 1993) pallet packers in a warehouse were taken to a supermarket to see pallets being unloaded. In this way, the novices appropriated knowledge about why the pallets have to be packed to withstand transportation, and the importance of the merchandise being in a good condition. Equally, the duties of the office junior taking files and mail around the city and visiting different businesses permits the appropriation of concepts about the nature of their business, the appropriate salutations on correspondence and expectations about the quality of work and timeliness of their completion.

However, concerns were reported in two studies (Billett, 1993 & 1994) about the potential to secure the depth of understanding required for complex work activities through workplace learning. Concerns about the development of conceptual knowledge are shared by Prawat (1993) who suggests that situated learning favours the development of procedures over propositions. Such concerns need to be acknowledged because, as Berryman (1993) reports, the increasing complexity of work is making many work tasks more opaque, requiring a rich conceptual base to understand and be effective in this work. Yet, putting concern aside for the moment overall, the studies reported that participants secured knowledge to resolve complex workplace problems, through workplace learning.

It is held that the active and constructive learner-focussed nature of engagement in workplace activities presses novices into a mode of knowledge acquisition, which is conducive to accessing higher orders of procedural knowledge and deeper conceptual knowledge (Stevenson & McKavanagh, 1994). It is these

forms of knowledge which are particularly useful for the transfer of knowledge to other circumstances. However, the securing of deep conceptual knowledge may require instructional interventions, particularly if the knowledge is opaque. From a constructivist view, the active engagement affords another key quality - reinforcement - the satisfaction that individuals experience when they are able to adapt new stimuli to their existing knowledge structure, or put more simply when they are 'making sense' of the stimuli (von Glasersfeld, 1987). As individuals acquire knowledge, they experience reinforcement as procedures become more effective, predictions are realised through monitoring and task goals are achieved to a standard required by the culture of the workplace practice. In these ways the three studies offer evidence of the potential that exists within the workplace for the development of purposeful vocational skills, a potential which can largely occur as part of everyday work practice.

5. POSSIBLE LIMITATIONS OF WORKPLACE LEARNING

Although the workplace offers the potential for rich learning outcomes, there are also barriers to realising the full potential of these settings. What follows is a set of possible limitations to the effectiveness of workplace learning. These limitations are: inappropriate knowledge; access to authentic activities; reluctance of experts; absence of expertise; opaqueness of some knowledge; and instructional media (see Table 2).

5a Inappropriate knowledge

Not all knowledge accessed in the workplace is desirable. The learning of inappropriate work practice or the development of negative attitudes and approaches may well result if these are present in the culture of practice. Although individuals construct their own versions of what they experience, the on-going participation in a culture which has negative elements of practice, will probably shape their understanding and approaches to goal-securing procedures in some ways. For example, if there is a pervasive set of beliefs about particular work practice this is likely to be appropriated by individuals, albeit to a greater or lesser extent. The pressure of the culture or desire to conform may result in deleterious outcomes. After all, most forms of situated learning occur in situations of unequal relationships between participants (Verodonik, et al, 1988). So, the culture of practice is likely to be highly influential, which is either a virtue or a problem depending on orientations of the culture of practice. Consequently, the existing workplace culture and values are likely to play a role in determining the types of knowledge that are constructed. So, if existing beliefs are counter to those the sponsors desire, then everyday work practice may well frustrate the sponsor's goals. It may therefore be necessary to be selective about access to expertise and activities in the development of skills.

5b Access to authentic activities

The potency of situated nature of learning, embedded in a community of practice, is likely to be determined by the guided access to authentic activities which press learners into increasingly effortful thinking. Barriers to accessing either activities or guidance are likely to have negative consequences for learners. If they are denied engagement in activities which are increasingly challenging it is likely that the learning outcomes will be constrained. Also, as stated earlier, access to on-going authentic vocational activities need to be sequenced in such a way as to take the novice from engaging in peripheral through to increasingly complex tasks, and those that allow the learner to access both the process and the product of those activities. Therefore workplace learning requires the development of a learning curriculum (Lave, 1990) which organises a pathway of guided experiences. Unless such a pathway is set out for learners' experience in the workplace they may well, not of themselves, offer the best opportunity for developing skilful knowledge.

5c Reluctance of experts

Reluctance by experts to provide advice, modelling, coaching and on-going support, may severely inhibit the outcomes of workplace learning. A workplace environment in which novices will be encouraged to access models, coaching and seek insights is, again, likely to provide stronger outcomes. However, expert workers may be reluctant to share their knowledge for fear of loss of status or even concerns about displacement by those whom they have guided. Significantly, in Japanese corporations, where workplace learning is used widely, although their roles include training subordinates, supervisors are secure in the knowledge that their promotion is based on seniority (Dore & Sako 1989). These experts provide learning experiences for their subordinates without any concerns about displacement, by those whom they have trained. Consequently, if a situation of uncertainty exists in the workplace, reluctance of experts to provide guidance may be present a major limitation to workplace learning. Therefore, the certainty that experts have about rewards and the lack of fear of displacement may have an important impact on workplace learning.

5d Absence of expertise

A lack of expertise or access to expertise is also likely impact upon learners in workplaces. In these situations expertise external to the community may be required to provide the guidance, modelling and coaching role. However, any external expertise has to acknowledge the conditions under which vocational practice is conducted - the culture of practice. In one of the studies (Billett, 1992b) coal workers stated that the technical teachers at a nearby vocational college lacked an understanding of how work was conducted in coal mines. Yet, in another study (Billett, 1994), novice staff worked alongside experts from overseas

during the commissioning of the plant. In doing so, these novices gained important understandings and insights which have allowed them to take responsibility for the plant's operation and respond to problems that arise during production. This emphasises the importance of access, which is supported by the degrees of frustration experienced by remote learners who lacked access to expertise (Billett, 1993). Consequently, access to expertise is likely to be an important factor in workplace. However, as reported consistently in the studies, the learner will determine who is and is not an expert, in much the same way as judgements about the successful performance will be determined within the community of practice.

5e Opaque knowledge

As stated above, there are concerns about the development of conceptual knowledge through workplace learning. The studies indicate that, despite the concerns of Prawat (1993) and some participants, propositional knowledge is developed through guided everyday activities in the workplace. Yet, particular guidance is likely to be required to develop deep understanding about knowledge that is opaque and hidden from the novices. With the advent of new technologies, knowledge is becoming increasingly opaque and, therefore, remote from sight and touch. This opaqueness makes for inaccessibility. As Berryman (1993) notes and Martin and Scribner (1991) have demonstrated, evolving technologies and work practices require deeper understanding, yet the conceptual knowledge required for this understanding is often impenetrable for the novice. Instructional interventions may be required to make what is opaque accessible. These interventions might include verbal descriptions, analogies, diagrams or even linkages between disembodied theoretical principles and actual applications of those principles.

5f Instructional media

The limitations of instructional media in the workplace, need to be acknowledged. These learning arrangements, such as computer-based and text-based learning systems, are commonly proposed as training solutions for workplaces. However, a reliance on such media is cautioned, as they offer access to forms of knowledge which are frequently disembodied from the activities which they claim to be addressing (Billett, 1994). This means that the individual has to transfer the knowledge from the context of acquisition to their application in the workplace. In addition, these types of learning arrangements are most likely to be generative of certain types of knowledge, particularly very specific procedures and low-level propositional knowledge, which are not, of themselves, likely to assist with achieving complex work performance. Therefore, these 'training solutions' are unlikely to develop the rich array of knowledge types required for complex performance. To counter the limitations of these instructional interventions, some initial authentic experiences should provide a robust basis for the instructional media to build upon.

In addition, a structured integration between authentic and instructional experiences are necessary to guide the development of robust cognitive structures.

Table 2
Factors limiting efficacy of workplace learning

Limiting Factor	Consequence and possible response
undesirable knowledge	- inappropriate learning outcomes . selection of circumstances and expert others
access to activities	- development of knowledge inhibited by paucity of experience . develop a learning curriculum to allow a pathway of experiences - from simple to complex, but also those that reveal the entire characteristics of work activity
reluctance of experts	- limits on access to expert guidance may reduce modelling, coaching and support . establish conditions whereby experts are encouraged to act as mentors and guides
absence of expertise	- limits on access to expertise will reduce guidance and support . provide access to forms of expertise . assist making external expertise relevant to particular circumstances
knowledge which is opaque	- depth of understanding may be inhibited if knowledge is remote from learner . making explicit what is hidden . use of instructional interventions to make knowledge accessible
instructional media	- limits on types of knowledge and their embeddness in practice . provide authentic experiences initially . integrate instructional interventions with authentic experiences

In this section some limitations about workplace learning have been advanced. The purpose of appraising the limitations is to suggest practices which might, if addressed, reduce their impact. However, it is acknowledged that not all these limitations are readily able to be addressed. The concerns about the development of conceptual knowledge has been restated and some strategies have been offered.

5. CONCLUSION.

This paper has offered an account of a basis for, and the likely consequences of, workplace learning. It is suggested that, with guidance, everyday work activities when effectively structured provide opportunities for accessing and constructing robust and transferable vocational knowledge. From a synthesis of three studies into workplace learning, it is concluded that the qualities of workplaces most likely to secure this knowledge are those that structure activities which assist individuals to move from peripheral activities to those which are more central to the functioning of the particular work practice; that provide expert guidance which presses individuals into accessing more complex forms of knowledge and which explicitly illuminate that which is not readily revealed. Ironically, these instructional qualities are those shared with what might be expected within an effective formal educational environment. The key

difference is the authenticity of the social and cultural context, in terms of its relationship to the knowledge to be developed and its direct application to work practice. As well as highlighting the attributes of workplace learning a set of factors which might be inhibit the acquisition of knowledge are offered. If these factors can be marginalised then the full potential of workplace learning may be realised.

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