Towards a model of workplace learning: The learning curriculum

Stephen Billett
School of Vocational, Community and Technology Education
Faculty of Education
Griffith University

To understand the nature of learning in workplaces and how this learning might be improved, it is useful to view the activities that learners engage in as key units of curriculum. These learning experiences, which workers engage in as part of everyday work practice, should be conceptualised as goal-directed activity shaped by the context and requirement of the particular community of practice in which those activities occur. This paper draws upon current theorising and empirical work in order to provide an initial model of a workplace learning curriculum. The model suggests that learning rather than teaching should be at the core of concepts of curriculum. Commencing with a review of goals for vocational expertise, learning through goal-directed activity and a synthesis of some recent research into learning in workplaces a tentative model of workplace learning is advanced. Features of this model include guided participation in the everyday activities of the workplace with explicit interventions aimed at providing access to forms of knowledge which remain opaque and the development of procedures. The overall structure of the learning arrangements is referred to as the learning curriculum with activities being advanced as key components of the curriculum model. Although founded within workplace communities of practice, this model may well have wider applications.

## INTRODUCTION

As the understanding about learning evolves, with the broadening acceptance of it being a socially mediated and constructive process, it becomes necessary to re-appraise how we think about learning arrangements and the concept of curriculum. This paper proposes a view of learning and curriculum which emphasises guided participation in the authentic activities of particular communities of practices (workplaces) with the intent of developing expertise. Central to this view is that learning is equated to the process and outcomes of participation in goal-directed activity, with social situations and circumstances influencing the nature of activities and, hence, outcomes of participating in those activities. Moreover, a view of curriculum is advanced which gives primacy to learning rather than teaching. The concepts advanced in this paper are not restricted to participation in workplaces, rather they can be extended to include other forms of human activity and may influence views about learning in educational institutions.

In order to advance a concept of curriculum based on engagement in goal-directed activity in a particular community of practice it is necessary to, firstly, advance a view about goals for learning. As this paper is primarily concerned with workplace learning, these goals are the forms of knowledge required for vocational expertise. However, both workplaces and educational institutions are seen as being types of communities of practice, with the quality and transferability of outcomes being a product of the activities

learners engage, not that one community might view its primary purpose as teaching. A community of practice is defined as a set of relations among persons, activity and world, over time and in relationship with other tangential and overlapping communities of practice (Lave & Wenger, 1991, p.98). It is the knowledge required for expertise in a community of practice which is aimed to be developed through this view of curriculum. Next, a constructivist view of learning is advanced which emphasises problem-solving as a means to construct, organise, index and extend knowledge. Following this, the synthesised findings from a series of studies in workplace learning are provided to substantiate claims for the strengths and limitations of workplace learning experiences. These studies provide deductions about learning through participation in everyday activities within communities of practice. Finally, propositions about structuring the learning curriculum are advanced as a tentative model of workplace learning. Whilst not claiming to be comprehensive or complete this initial model provides the basis for considering curriculum as engagement in goal-directed activities which are structured to provide access to the forms of knowledge required for expertise and are associated with expertise (Chi, Glaser & Farr, 1982).

**GOALS FOR CONSTRUCTING VOCATIONAL KNOWLEDGE**

Cognitive theory holds that representations of knowledge in memory underpin how individuals think and act (Anderson, 1982). These representations are described as cognitive structures, comprising propositional and procedural forms of knowledge (Stevenson, McKavanagh & Evans, 1994), and the interlinking and organisation of those structures into sets of schemata (Yates & Chandler, 1991). Higher orders of procedural knowledge (Stevenson, 1986a) or executive strategies (Evans, 1991a) and deep layers of conceptual knowledge (Evans, 1991b) assist in the construction and effective deployment of schemata.

Two forms of cognitive structures are usually delineated in the cognitive literature. Propositional knowledge or *knowledge "that"* (Ryle, 1949), also termed declarative knowledge (Anderson, 1982), comprises facts, information, assertions, concepts and propositions. This form of knowledge comprises levels of stateable facts or concepts (Evans, 1991b), which range from simple factual knowledge (e.g. names of capital cities) through to deeper levels of conceptual knowledge (such as principled understanding about workings of law, the human body or a piece of equipment). Depth of understanding includes the strength of relationships among concepts (Groen & Patel, 1988; Novak, 1990), thereby emphasising interconnectedness as a basis for deep understanding (Prawat, 1989). Novel tasks require the problem-solver to go beyond the surface features of a problem situation in order to access its deep features (Chi, Feltovich & Glaser, 1981; Gott, 1989). Therefore, deep conceptual knowledge facilitates the resolution of complex problem-solving, such as the transfer of knowledge to novel situations (Pea, 1987; Royer, 1979). Well-structured and accessible conceptual knowledge also reduces the need for the application of strategic forms of knowledge to formulate goals (Garner, 1990). Moreover, deep conceptual

knowledge, within a domain, also provides a basis for determining what is salient or trivial in problem situations, thus aiding their resolution. The ability to effectively categorise, and hence solve complex problems, is a hallmark of expertise. Hence, a body a deep conceptual knowledge, within a domain, is required for expert performance (Chi, et al., 1982).

Procedural knowledge (Anderson, 1982), also termed *"knowledge how"* (Ryle, 1949), enables skilful action and comprises techniques, skills and the ability to secure goals (Stevenson, 1991). It has been classified into levels or orders (Alexander & Judy, 1988; Evans, 1991a; Scandura, 1980; 1982; Stevenson, 1986a; 1991). Stevenson (1991) proposes three levels of orders. First order or specific procedures are employed to achieve specific goals. Being specific only to routine situations, specific procedures are not effective when non-routine or ill-defined tasks are encountered. Consequently, monitoring, evaluation and strategy selection - the second-order procedures - are invoked. The second order includes those needed for breaking the task up into a series of sub-goals (Greeno & Simon, 1988) or engaging in means-end analysis (Newell & Simon, 1972). First and second orders are managed by forms of third or higher-order procedural knowledge, which act upon lower orders of knowledge (Evans, 1991a; Scandura, 1982; Stevenson, 1986a, 1991), by monitoring and organising activities, and by switching between orders, when necessary (Scandura, 1982; Stevenson, 1991).

Therefore, the role of higher order procedures is particularly important in thinking processes associated with non-routine activities, such as complex problem-solving (Gott, 1989) and the transfer of knowledge to novel situations (Royer, 1979; Stevenson, 1991). Facility with complex problem-solving within domains of knowledge is a distinguishing quality of experts (Anderson, 1982; Ericsson & Simon, 1984). Anderson states that the "ability to perform successfully in novel situations is the hallmark of human cognition" (1982, p.391). Higher order procedures monitor performance during problem resolution and predict likely outcomes of performance, thus consciously guiding action in a way quite different from that enacted through the deployment of automated specific proceduralised knowledge. For example, while higher order procedures allow an expert to focus on novel aspects of the problem, if the solution does not begin to unfold as is expected, the monitoring will suggest that perhaps an incomplete diagnosis has occurred. The motor mechanic discovering water in a part of the motor, which was not expected is given clues that perhaps the initial solution may be flawed, thereby suggesting other solution strategies.

**Dispositions**

Having considered cognitive structures in terms of deepening layers of propositional knowledge and orders of procedural knowledge, a gap becomes apparent in the cognitive literature - the dispositions

which underpin these representations and their schematic linkages and organisation. Earlier, reference was made to Ryle's (1949) categories of knowledge "that" and knowledge "how". In reviewing this work, Martin (1970) noted that some behaviour did not fit into either of these categories. For instance, how can being pleasant to customers in a retail or restaurant setting, or the appropriateness of the level of checking and self-monitoring required of a motor mechanic, be categorised? These behaviours are best conceptualised as dispositions.

<u>Dispositions</u> comprise attitudes, values, affect, interests and identities (Prawat, 1989). Perkins, Jay and Tishman (1993a, 1993b) regard dispositions as individuals' tendencies to put their capabilities into action. Although the role of higher order procedures - knowing how and when to apply knowledge - has been acknowledged above, this does not adequately account for dispositions - putting capabilities into action. Higher order procedures are concerned more with the efficacy of securing goals, than with whether the learner thinks they are worth securing (Dweck & Elliot, 1983; Goodnow, 1990; Tobias, 1994) or whether individuals possess the personal confidence or motivation to proceed with the task (Belenky et al., 1986).

Dispositions determine whether individuals value a particular form of knowledge enough to be willing to participate in the effortful activity required to secure that knowledge. This has direct implications for the learning process and its outcomes. For example, learners with a performance orientation, may determine if participation in an activity will result in their "looking smart", which is quite a different tendency from those who seek to determine what they will learn from an activity before participating (Dweck & Elliot, 1983). In this way, dispositions are socially influenced and are subject to what is valued in particular situations. Grusec and Goodnow (1994, p.16) argue that affect and cognition need to be seen as influencing each other in ways that are not likely to be unidirectional or simple. Therefore, dispositions need to be viewed as being inherent, underpinning but not separate from cognitive structures, in cognitive activity such as schemata acquisition and its deployment. Moreover, dispositions are likely to be influenced by social and cultural factors experienced through individuals' personal history.

**Routine and non-routine problem-solving**

Problem-solving is central to thinking and acting, and is argued below, learning. However, reference to problem-solving includes responses to both routine and non-routine problems set in social circumstances. For example, decisions about what clothes to wear or what route to take are problem-solving activities. The tasks of choosing among sets of work clothes or routes to work are routine problems, because they are easily addressed. However, choice of clothes to attend an interview, or social occasion, or the route to an unfamiliar part of town, may present a novel situation. The former problems are routine as the variables are known, thus making a solution choice relatively easy. However, in non-routine situations not all variables are known, so individuals recall similar situations from the past to establish a basis for decision-

making, all of which may require access to conceptual understanding and higher procedures. With routine problems, schemata are deployed to resolve the problem, requiring little conscious or effortful engagement of cognitive structures. However, small adjustments or manipulations which require conscious effort may be needed, when the existing knowledge is not directly applicable to new situations. So responding to non-routine problems is a major function of conscious, controlled thinking, and is now being associated with learning (Anderson, 1993; Shuell, 1990) and transfer (Royer, 1979). On the other hand, ongoing routine problem-solving activity reinforces knowledge. Together these activities contribute to what Rogoff (1990) refers to as microgenetic development, the moment by moment learning that occurs through engagement in socially determined activities.

Therefore, problems can be delineated into those which require little conscious and effortful thinking -- routine problems -- or those problems which are novel, requiring extensive conscious thinking and searches of existing schemata in memory -- non-routine problems. However, the delineation between routine and non-routine is person dependent. What for one individual may be a routine problem could be novel to another. Moreover, how individuals represent problems may determine whether they are treated as routine or non-routine, as individuals may turn a routine task into a non-routine problem (Simon, 1973).

Consequently, problem-solving, which is dependent upon the representation and categorisation of the problem situation is central to expert performance. So it is held, that securing the types of cognitive structures which permit expert performance (e.g. non-routine problem-solving) in particular circumstances is the goal for programs which aim to develop vocational knowledge. Moreover, as these cognitive structures are not value free or universal their dispositional underpinning have to be acknowledged. As dispositions are in part situational, the development of these cognitive structures needs to address the values and requirements of the situation(s) where the expert performance will be judged. What is an expert solution in one setting, would be classified as indulgent in second and inappropriate in a third (Billett, 1995b).

**CONCEPTUALISING LEARNING**

From the previous section it can be seen that research within cognitive psychology has focussed on understanding complex human performance, and the knowledge structures that underpin that performance. Central to complex thinking is the ability to negotiate impasses to secure solutions. As noted above, non-routine problem-solving is central to the performance of complex tasks, and is characterised by Newell and Simon as that activity undertaken by "a person confronted by a problem when he [sic] wants to do something and does not know immediately what series of actions he can perform to get it" (1972, p.12). Resolving a problem involves utilising cognitive structures to manipulate the problem situation in order to

achieve a solution. However, more than just resolving impasses, problem-solving is now viewed as the basis for learning and, hence, cognitive development (Anderson, 1993, Shuell, 1990).

Early work in cognitive psychology imposed needless distinctions between the cognitive activities of problem-solving and learning (Anderson, 1993). Shuell (1990) concurs, viewing learning as an active, constructive, cumulative and goal-oriented process that involves problem-solving. Other constructivists also view learning as resulting from the resolution of an impasse, with "learning only occurring when an impasse occurs" (Van Lehn, 1988, p.38), and the search for viability (von Glasersfeld, 1987) being equated to problem-solving. Equally, Piaget's concept of equilibrium, being about making adjustments to existing knowledge to accommodate new stimuli, is also analogous to problem-solving (1968; Piaget & Inhelder, 1973). Rogoff (1990, p.8) suggests that "cognition and thinking are defined as problem-solving, with thinking being functional and grounded in goal-directed activity". However, it is held that as problems and their solutions are set in social circumstances, such goal-directed activity is shaped by social circumstances and that these circumstances pattern knowledge and influence the construction of knowledge by individuals.

Consistent with the association between problem-solving and learning, an initial definition of <u>learning</u> has been synthesised from Best (1992), as turning an ill-defined problem into one that is well-defined, thereby making it categorisable and ultimately solvable. Cognitive development, it follows, occurs through problem-solving as individuals confront novel socially defined problems and utilise their representations of knowledge in memory to transform problems into ones which are solvable. However, learning is more than adding new knowledge to an existing base; it includes making connections and interacting with prior knowledge (Prawat, 1989). Accordingly, existing representations of knowledge in memory and cognitive processes work together in transformational activity to develop further cognitive structures and schemata. The transfer of knowledge from one situation to another is likewise seen as negotiating an impasse.

It is proposed, therefore, that learning, problem-solving and transfer are similar processes. They are contingent upon individuals' interpretive construction of the problem situation. This conceptualisation, is determined by individuals' interpretation, which is influenced by the indexation of cognitive representations in memory and their retrieval (Anderson, 1982). <u>Indexation</u> refers to the way knowledge is organised for further use or retrieval (Ericsson & Simon, 1984). This procedure is analogous to tagging information to aid its recall. The more richly indexed the cognitive structures, the greater the likelihood of their recall and utility in the formation of the problem-space (Ericsson & Simon, 1984). The clues and cues which underpin indexing are a product of previous problem-solving in socially determined situations (Brown, Collins & Duguid, 1989).

Indexing, is shaped by individuals' interpretations, which are the product of personal histories (Greeno, 1989a; Pea, 1987) which are themselves influenced by ongoing participation in social practice. Individuals construct their understanding, rather than simply internalising externally derived knowledge. This construction is patterned by the social circumstances in which cognitive structures are deployed and transformed because social and physical circumstances provide a basis for indexation and recall (Ericsson & Simon, 1984; Lave, Murtaugh & de la Roche, 1984). In doing so they provide another link between the social circumstance and cognitive structures.

What has been advanced above is that learning and development occurs through engagement in goal-directed activities which press individuals into routine or non-routine problem-solving. In the next section, workplaces are evaluated as situations where the processes of problem-solving occurs and forms of knowledge required for vocational expertise can be constructed.

## LEARNING IN THE WORKPLACE: ITS STRENGTHS AND LIMITATIONS

In this section salient findings from a series of studies into workplace learning(Billett, 1992, 1993a, 1993b, 1994, 1995a) are synthesised. These studies examine the consequences of participation in activities in the workplace as a means of securing knowledge and highlight some strengths and limitations associated with that participation. The key concerns are how these forms of knowledge referred to earlier can be constructed by engaging in problem-solving activities encountered as part of everyday workplace activities.

### Strengths

In preview, authentic activities, expert others, other workers and engagement in tasks are seen as the basis for effective learning in workplaces (Billett, 1995a). The construction of the knowledge required for expert performance is reported in the above mentioned studies as being realised through learning experiences that are authentic, thereby providing goal-directed activity (problem- solving) which has cognitive consequences of particular salience to workplace activities. Close or proximal guidance by other workers in securing workplace goals is valued by learners. It is held that, everyday participation in work tasks provides opportunities for learners to generate tentative solutions to vocational tasks and then attempt to secure those solutions. This results in knowledge being indexed and organised in ways that is purposeful in terms of the successful securing of workplace goals. Such a guided approach to learning provides the opportunity for learners to develop increasingly mature approximations of the procedures required to be successful in these tasks, through a process of testing and modifying their approximations.

As these procedures are tested and modified it is likely that concepts associated with goals and subgoals will become deepened through rich associations, linkages and purposeful organisation. Over time, it is proposed, this activity results in the development of a repertoire of goal-securing schemata which are richly associated with the circumstances of their acquisition through routine and non-routine problem-solving. Indexing to the social environment provides a form of mediation which draws upon the social and cultural contributions (clues and cues) of the particular setting (Brown, et al., 1989).

The interaction with expert others guides the learners' tentative solutions to tasks and the means of securing goals (Billett, 1994). Experts provide the means for achieving task goals, through proximal guidance and more distal contributions such as access to further practise and increasingly complex tasks. This proximal interaction is analogous to the modelling, coaching and scaffolding of the approach to learning referred to as cognitive apprenticeships (Collins, Brown & Newman, 1989) in what Vygotsky (1987) refers to as the Zone of Proximal Development. That is the array of the tasks that can be successfully accomplished with the assistance of an expert, which otherwise could not be accomplished, by learners on their own. Indirect or distal forms of guidance also provide sources of supplementary mediation for the construction of knowledge. For example, listening to and the observation of other workers in the workplace is reported to assist the learner with the conceptualisation and approximations of workplace tasks (Billett, 1994).

It is proposed that the active and constructive learner-focussed nature of engagement in workplace activities presses learners into goal-directed activity, is conducive to accessing higher orders of procedural knowledge and deeper conceptual knowledge, as well as the development of more specific forms of knowledge (Billett, 1993a; 1993b; 1994; 1995b). It is these forms of knowledge which are particularly useful for the transfer of knowledge to other circumstances. From a constructivist perspective, the active engagement in routine problem-solving activities affords another key quality -- reinforcement -- the satisfaction that individuals experience when they adapt new stimuli to their existing knowledge structure, or, put more simply, when they are `making sense' of the stimuli (von Glasersfeld, 1987). This is an important distinction between views which are premised on the nature of learning as being externally directed (e.g. behaviouralists), where reinforcement is linked to external endorsements, and constructivist views where reinforcement is the internal gratification realised through making sense of a novel stimuli through a process of interpretative construction. From this view, 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 particular workplace practice. In these ways, the above mentioned studies offer evidence of the potential that exists within

workplaces for the development of purposeful vocational knowledge, a potential which can occur through everyday work practice.

**Limitations**

Although workplaces offer the potential for rich learning outcomes, through participation in everyday practice, 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 (Billett, 1995a). These limitations are: (i)the construction of inappropriate knowledge; (ii)access to authentic activities; (iii)reluctance of experts; (iv)access to expertise; (v)opaqueness of some knowledge and (vi) access to instructional media. Underpinning the limits to workplace learning is that workplaces, like any other settings, are inherently value-laden. Values associated with the goals of the organisation (e.g. productivity , service) and of those individuals working the setting (e.g. personal or sectional interests) cannot be denied as they influence the nature, type and access to the activities which influence cognitive development. Consequently, the array of activities and access to these activities are constrained by personal and organisational preferences and goals.

*Inappropriate knowledge*

Not all activities in workplaces may lead to the development of appropriate knowledge. The construction of inappropriate knowledge, including attitudes and values may result if these are present and rewarded in the community of practice. For example, dangerous work practice or exclusive views about gender and race might be pervasive. As most forms of situated learning occur where relationships between participants are unequal (Verodonik, et al, 1988), the nature and values embedded in workplaces are likely to play a role in determining the types of knowledge that are constructed. Therefore, despite individuals ultimately constructing their own version of knowledge, the press of the community or desire to conform may result in deleterious learning outcomes. So, for example, dangerous or shoddy work practice might be appropriated because such practice is a community norm.

*Access to authentic activities*

Limits to accessing either activities or guidance are likely to have consequences for learners. The potency of learning is determined by the quantity and quality of guided access to authentic activities which press learners into problem-solving. If learners are denied engagement in activities which are increasingly challenging, it is likely that the learning outcomes will be constrained. Access to work activities need to be sequenced to take the novice from engaging in peripheral activities through to increasingly complex tasks.

Moreover, those activities which allow the learner to access both the process and the product of those activities need to be included.

*Reluctance of experts*

As stated above, workplace environments in which novices are furnished with models, coaching and insights are likely to provide rich learning outcomes. However, reluctance by experts to furnish these interactions may severely inhibit the outcomes of workplace learning. Expert workers may well be cautious about sharing their knowledge for fear of loss of status or even concerns about displacement, by those whom they have guided. In Japanese corporations, where workplace learning is used widely, supervisors, whose roles include training subordinates, are secure in the knowledge that their promotion is based on seniority (Dore & Sako 1989). These experts provide learning experiences for their subordinates without concerns about displacement by those they have trained. Experts who are not rewarded or fear displacement may be unwilling to provide the proximal guidance and access to increasingly complex tasks which is essential for learners. A particular issue in the Australian context is concern about industrial affiliation in which particular jobs are undertaken by particular groups of workers. So, for example, a tradesperson may be reluctant to show a non-tradesperson a particular task, if they believe it may jeopardise the tradesperson's interest.

*Access to expertise*

A lack of available expertise will be likely to have a negative impact upon workplace learning. Although expertise external to the community may be required to provide guidance, any external expertise has to account for the conditions under which work practice is conducted. For example, in one of the studies (Billett, 1993a), coal workers stated that the technical teachers at a nearby vocational college lacked an understanding of how work was conducted in coal mines. However, in another study (Billett, 1994), novice staff worked alongside experts from overseas during the commissioning of a secondary processing plant. In doing so, these novices gained important understandings and insights which have allowed them to take responsibility for the plant's operation and to respond to problems that arise during production. Access to expertise is likely to be an important factor in workplace learning, therefore limit to access could have negative outcomes. However, as is reported consistently in the studies, the learner determines who is and is not an expert.

*Accessing conceptual (propositional) knowledge*

Concerns were reported in two studies (Billett, 1993a & 1994) about the inability of workplace learning activities to secure the depth of understanding required for complex work activities. Prawat (1993) also suggests that situated learning may favour 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 tasks more opaque, requiring a rich conceptual base to understand and be effective in these more complex forms of work. The studies indicate that, despite the concerns of Prawat (1993) and some participants, propositional knowledge is developed through guided everyday activities in the workplace. However, close guidance and even instructional intervention is likely to be required to develop understanding about knowledge that is opaque and hidden from the novices. For example, black box technology, computer-driven processes, complex forms of work organisation are making knowledge inaccessible. Yet the conceptual knowledge required for this understanding is often inaccessible to the novice without proximal guidance of an expert.

*Instructional media*

Currently, much of the effort to manage learning in workplaces is grounded in the use of various forms of text-based instructional materials. These media, such as computer-based and text-based learning systems, are often proposed as training solutions for workplaces. However, it is reported that such media offer access to forms of knowledge that are disembodied from the activities for which they claim to be developing knowledge (Billett, 1994). The knowledge, so constructed, has to be transferred from the context of acquisition to application in the workplace in order for knowledge to be deployed. This is because the type of knowledge developed through interacting with these texts does not develop the types of knowledge required to secure goals in novel circumstances. 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 complex work performance.

In this section, strengths and limitations of constructing the forms of knowledge required for expert performance through everyday activities in the workplace have been advanced. In the next section, a tentative model of workplace learning -- the learning curriculum --is described drawing on current theorising and empirical work. The approach to organising a learning curriculum presented here depends upon access to activities that provide guided opportunities to engage in problem-solving that is conducive to generating the forms of knowledge outlined earlier. Consequently, engagement in tasks is viewed as being the basic unit of curriculum and the organisation and sequencing of those activities is central to the learning curriculum, such as has been advocated by Posner (1982).

**STRUCTURING THE LEARNING CURRICULUM**

From what has been advanced above and taking into account the constructive nature of learning through problem-solving, a view of curriculum which focuses on learners' participation in goal-directed activity is advanced -- the learning curriculum (Lave, 1990). This view focuses on providing access to goal-directed

activities and forms of guidance that are conducive for the development of forms of knowledge which are applicable to the particular circumstances, yet also robust enough to maximise the potential for transfer to other situations.

Table 1 - The learning curriculum

| Component | Quality | Attribute |
|---|---|---|
| Activities | A pathway of activities | (i) movement from peripheral to full participation<br>(ii) access to process and product |
| | | |
| Guidance | Close (proximal) | (i) proximal guidance by experts<br>(ii) choice and sequencing of activities |
| | Distant (distal) | (i) other workers<br>(ii) activities<br>(iii) physical environment |

Hence the development of procedural knowledge has to be complemented by the access to conceptual knowledge, which may be opaque, and through these the deployment and, hence development, of strategic forms of procedural knowledge. The components of the learning curriculum are presented in Table 1 which proposes that the learning curriculum has two key components: activities and guidance. In the next section these are discussed more fully.

**Activities**

Firstly, it is necessary to delineate a pathway of work activities that learners need to access and in which to become competent in to participate fully in the community of practice. The delineation of this learning pathway is used to determine how workplace learners might move from the work activities undertaken by novices to those of experts. This pathway is, thereby, founded on the movement from peripheral activities to full participation in work activities - that is, from those activities which are less important and complex, to those which are usually more complex and may carry greater accountability (see Lave & Wenger, 1991). In doing so, this movement necessarily involves the construction of those forms of knowledge required for expertise identified earlier. The delineation and sequencing of this pathway of activities has to address two requirements: (i) the need to sequence workplace activities that are of increasing complexity which permit the learner to experience incrementally more accountable tasks and goals, and (ii) the need to create a pathway that affords learners the opportunity to access both the product and the process of the workplace activities. Access to the outcomes of work activities permits the development of goals for practice. This means that, early in the learning pathway, there have to be opportunities for learners to access and understand the outcomes of their work activities. This access permits the development of

understanding about what their activities are contributing towards and also the standards associated with those activities. In an earlier study (Billett, 1993b), it was reported that, novice warehouse workers were taken in a delivery truck to supermarkets to see the goods they had packed onto pallets unloaded. This experience allowed these novice workers to appreciate the importance of care and thoroughness in packing the pallets to withstand the rigours of long road journeys thereby arriving in saleable condition. Making the goals for activities accessible is useful in establishing the goals to be secured in workplace practice, which then can become goals for learners.

The delineation of the learning pathway might involve determining the sequence in which experts believed they constructed their skills and comparing this with the experiences of recent trainees. In addition, structured opportunities to access the product could be built in. For example, coal workers might be rostered on to work in a coal loading or preparation plant, to understand the importance of the different types of coal and the avoidance of foreign matter. Process workers might be given access to experiences in sampling activities to develop an understanding about quality requirements or the finished product. Novice carpenters, for example, might be shown completed or semi-completed buildings to develop their goals for practice. Deliberations about these components would aim to generate the most effective learning activity pathway, and the structuring of the opportunities so that the pathway provides the access to both the process (means of securing goals) and the product (what those goals might be). The pathway can be used to manage the sequencing of tasks which novices will have to access to as opportunities arise for participation. Moreover, to counter the limitations of instructional media, some initial authentic experiences should provide a robust basis for the instructional media to build upon. Furthermore, a structured integration between authentic and instructional experiences is necessary to guide the development of robust cognitive structures.

**Guidance**

There are different levels of guidance required to maximise the potential of the learning curriculum, as depicted in Table 1. These are delineated into proximal (close) and distal (distant) forms of guidance.

*Proximal guidance by experts*

The above mentioned investigations into workplace learning emphasised the importance of learners' interaction with expert others in the development of skilful knowledge. Consistently, in these studies, it was reported that access to experts was highly valued. However, it was the learners who decided who possessed expertise. Those workers who were acknowledged by others as being experts were seen as credible sources of knowledge. Therefore, there would be no guarantee that someone entitled `the trainer' or nominated workplace mentor would be granted this status by workplace learners. The guided support of

experts provides access to goals and procedures through joint problem-solving. This attribute needs to be encouraged further with the learner being placed in the position of increasing participation in the joint problem-solving process by more expert others. The role of the expert becomes one of guidance for the problem-solving with the novice being encouraged to take the lead in the problem-solving activity. This form of guidance should be permissible within the constraints of everyday work practice. Instead of experts telling the learners that "what we will do here is..." this is changed into a question, such as "what do you think we should do here?" and "why?". This joint problem-solving approach places the learner in an active problem-solving role. As mentioned above, the model of guided learning which can be used by workplace experts is the concepts of cognitive apprenticeships (Collins, et al., 1989). This approach to guided learning, which includes modelling, coaching, guidance and fading, seems particularly applicable for use by experts to make potent their guidance of workplace learning. To make opaque knowledge accessible, instructional interventions, such as verbal descriptions, analogies, diagrams or even linkages between disembodied theoretical principles and actual applications of those principles are needed.

The second aspect of the proximal guidance by experts is in the choice and sequencing of activities for the novice. The management of the provision of experiences and opportunities is likely to be germane in securing a purposeful movement through the pathway of activities. Rather than the provision of experiences in which the novice may not enjoy success and fail to find opportunities for repeated practice, there is need for the nature of the experiences and access to be guided. This guidance could be in the form of judgement by the expert as to the appropriateness of the learners' pace and to the complexity of tasks that the learners should access. As stated above, Vygotsky (1987) refers to the Zone of Proximal Development (ZDP), which is the ability of the learner to succeed at a task with guided support. It is suggested that experts should decide the pace and sequence of the novices activities based on the ZDP.

*Distal guidance*

Participants in everyday activities in workplace settings are able to access distal forms of guidance from the physical environment and also other workers. This distal guidance provides clues and cues, models and goals which are ubiquitous forms of ongoing everyday guidance and influence the microgenetic development of individuals' knowledge. In these studies, these forms of guidance were reported as being strongly associated with the development of skills for workplaces. The salience of these forms of indirect guidance are reported as being greater than more structured and deliberate approaches to develop vocational knowledge (Billett, 1994). So, over time, the distal guidance that is accessed through participation in the everyday workplace activities provides rich indirect guidance through the provision of clues and cues.

## CONCLUDING DISCUSSION

What has been argued above is that the concept of curriculum needs to be re-conceptualised with a focus on learning rather than teaching. As the understanding of the constructed nature of learning widens it is necessary to place learning at the centre of deliberations about curriculum. As learning is associated with participation in goal-directed activity, the nature of activity becomes important, and as argued above, the sequence and focus needs to be organised to emphasise movement from peripheral to full participation in a community of practice. The authenticity of activities and environments also play a role in the construction of knowledge. Using findings from a series of workplace learning studies, it is held that this authenticity is of particular importance in securing the specific forms of cognitive structures required for expert performance in particular communities of practice (workplaces). The need to avoid ersatz activities may be necessary to maximise transfer from the circumstances of learning to its deployment in work activities. Authentic activities and environments provide a rich array of opportunities to index and organise knowledge thereby enhancing the prospect of transfer. Workplaces, and the activities and guidance they provide through everyday practice provide the basis for securing vocational knowledge

The concept of the learning curriculum stated above needs to be viewed as an intended curriculum. It is advanced that just as with the taught curriculum, what is planned is not always what is enacted or constructed. Workplace activities are likely to influenced by concerns that limit learners' access to the learning pathway and the guidance required. However, what has been advanced here is an approach to organising learning experiences in environments in which learners can engage in goal-directed activity which, if structured and guided, should allow these to develop the forms of knowledge required for expertise. As such, a model of curriculum is advanced that focuses on the learner engaging in activities promoting a constructivist view which may have applications beyond workplaces as formal education institutes are also communities of practice with another set of goal-directed activities.

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