

Searching for authenticity  
- a sociocultural perspective of vocational skill development.

Billett S (1994) Searching for authenticity - a sociocultural perspective of vocational skill development.  
*Vocational Aspects of Education*, 46(1) 3-16.

Abstract

This article proposes an approach to vocational skill development which emphasises the authenticity of learning experiences. Authenticity is defined in terms of a sociocultural construction of vocational knowledge. Using empirical data, current research and theorising, it is argued that learning arrangements situated in the workplace presents a viable option for the development of vocational skills. Particular significance is afforded to the sociocultural contribution to problem-solving and the transfer of learning. These key qualities of thinking processes are used to illustrate the pervasive nature of a sociocultural construction of understanding within vocational practice. Theoretical bases within cognitive psychology, sociology and cultural psychology are drawn upon to present a concept of learning which includes the authenticity of activity and the guidance of expert others within a culture of vocational practice. The article attempts to make explicit the application of this emerging view of thinking and acting to vocational activities and the development of vocational skills.

Stephen Billett

School of Adult and Vocational Education

Griffith University  
NATHAN 4111

Brisbane, Queensland

Australia

## **INTRODUCTION.**

This article examines workplace learning experiences and argues that the utility of such arrangements should be reconsidered in the light of recent research and theorising. Some recent studies of skilled workers and skill development processes are described and summarised. A theoretical basis for evaluating the learning processes associated with the development of vocational expertise is then outlined. Current research and theorising within cognitive psychology and sociology is also addressed next to support a sociocultural construction of knowledge and understanding. The contribution to transfer and problem solving by contextual factors are then analysed. Finally, it is proposed that the development of robust and transferable knowledge may be facilitated by access to learning experiences which are socioculturally rich and authentic, and guided by expert others.

The provision of learning experiences which promote robust and transferable knowledge and skills is an enduring goal of educational practice. How to secure this goal remains the source of much debate, research and theorising. However, deliberations about educational practice are currently responding to a growing acceptance of a sociocultural basis for thinking and acting thus precipitating fresh discussions about the nature of learning and instructional processes. A sociocultural approach to learning is evident in the current research into instructional processes being used to teach reading and mathematics (Palinscar and Brown; 1984; Collins, Brown and Newman, 1989). The instructional processes adopted in this work involves making explicit the expert practice of readers and mathematicians. The adoption of these instructional processes reflects a developing interest in situated cognition which values learning taking place within an authentic culture of practice (Brown, Collins & Duguid, 1989). The rationale for the development of these instructional processes within compulsory education is to enhance the transfer of learning from schools to non-school settings (Raizen, 1991). Given the interest in making explicit expert practice and learning situated in a culture of practice, it seems appropriate to examine the efficacy of settings which can make these contributions to learning. A natural choice for vocational education is to examine the workplace as a source of authentic learning experiences which are situated within a culture of practice.

### **1. SITUATED LEARNING - LOOKING AT THE WORKPLACE.**

Two recent studies concerned with developing an understanding about the attributes of skilled workers and how vocational expertise can best be developed, produced consistent findings. Skilled workers, who were the subjects of these studies, valued learning in the workplace because of the qualities of agency and activity - the guidance of experts and the authentic nature

of learning activities. In the first study, conducted in the coal mining industry of central Queensland, Australia, the respondents stressed the value of learning on-the-job, and learning from expert others as they undertook work tasks (Billett, 1992). These skilled workers stated that, for learning processes to be effective, they had to be pertinent to the activities, culture and social relations within the mine site. Instructional processes and instructors that failed to take account of the values and requirements of the setting were likely to be ignored by coal workers. In only a few situations was expertise external to the setting valued. For example the respondents valued external expertise associated with newly-purchased software and equipment. The 'vendor training' associated with recently purchased equipment provided valued insights into how the equipment worked. But support for external expertise was qualified. For instance, it was not valued in terms of how the newly purchased equipment was to be used. It was claimed that mine site workers knew more about the use of the equipment than the manufacturers. Anecdotal information which was provided about changes to equipment design being made on the advice of minesite workers seemed to support such a claim. Workers in the coal industry also emphasised the importance of instructional processes which took account of the requirements of the workplace culture and activities (Billett, 1992). These findings could be dismissed as being peculiar to an industry with an inherently strong culture and a tradition of informal skill development. However, such a dismissal should be cautioned. Many respondents had experienced a range of skill development processes, providing a basis for comparison. Tradespersons and professional engineers emphasised the value of learning in the workplace and gave workplace learning preference over what they had experienced in their more formal mode of skill development. The preferences of trades and professional workers appears significant. Their modes of skill development sets them apart from other minesite workers and contributes to higher status and remuneration. Consequently, their support of learning in the workplace is interpreted as an indication of its efficacy.

The outcomes of the coal industry study prompted a more comprehensive examination of vocational skills acquisition modes. The second study surveyed and interviewed a wide range of skilled workers in the retail, secondary processing, transport, hospitality and other industries (Billett, 1993). It aimed to compare three commonly utilised modes of vocational skill development and gauge their effectiveness using as subjects skilled respondents who had experienced one of the three modes. The three modes analysed in the study are the formal pre-employment, the integrated (apprenticeship) and on-the-job learning modes. Again, one of the clearest outcomes of the broader study was strong support for learning situated in the workplace. In all three modes there was strong support for the role of experts in the learning processes and also the utility of undertaking occupational tasks as part of a learning process. Indeed,

respondents who had problems of access to these types of learning arrangements often referred to the frustration and slowness of learning without expert support. Some of these respondents reported having developed strategies to access support. Significantly, they did not want just any support, they wanted assistance by experts who could provide insights. However, a number of skilled respondents did emphasise the need to develop theoretical knowledge and understandings, and expressed concern about the ability of workplaces to adequately provide these attributes.

Another significant outcome of this second and broader study was the complexity of tasks reported by all worker categories (professional, trades, skilled non-trade and 'unskilled'). Every category of workers reported engaging in higher order problem-solving activities as part of their work tasks. Surprisingly, the frequency of higher order activity was reported as being almost the same across all categories of workers. It could be inferred from this finding that learning arrangements for all levels of workers needs to address higher order activities such as problem solving and transfer. An associated finding was the claim by the majority of the respondents that the ability to undertake higher order cognitive activity had been developed in the workplace (Billett, 1993). Such a claim seems quite significant as the development of general attributes associated with solving problems and transfer of knowledge has been seen as the traditional domain of formal learning environments - schools, vocational colleges and universities, while informal settings have been seen as useful in the development of practical knowledge (Gott, 1989). Consequently, this paper proposes a fresh view of learning in informal settings such as the workplace. This view proposes that the workplace is able to promote the range of knowledge and attributes required of vocational experts. The next section describes and summarises some supportive theoretical developments, and in particular examines the sociocultural construction of knowledge.

## **2. WHY DO SKILLED WORKERS VALUE LEARNING IN THE WORKPLACE?**

What evidence is there that the workplace can provide the sort of outcomes that were being claimed by the respondents in the two studies mentioned above? To respond to this question it is useful to examine the emerging views about thinking and acting which are supportive of the authenticity of activity and agency.

### **A social and cultural base for thinking and acting.**

It is now almost commonplace to consider a social basis for learning (Goodnow, 1990). It is also acknowledged that the activities that people engage in structure cognition (Scribner, 1985), and that these activities are embedded with in socio-cultural practice (Rogoff and Lave, 1984). However, such views are only now gaining broad acceptance within educational research and

theorising. Earlier understandings of thinking and acting emphasised the pre-eminent role of the internal processes of the mind. However, this view persists as does a preference for developing learners' general thinking processes which are to be applied uniformly regardless of context (Bruner, 1966). The effectiveness of this approach awaits validation. So whereas previous generations of compulsory education students were guided into chess and Latin to discipline the mind and allegedly develop general thinking processes, currently computer programming is being used for similar purposes in a range of countries (Pea, 1987). However, as a result of extensive research into complex human performance (Glaser, 1984) a greater emphasis is now being attributed to domain specific knowledge and a belief that knowledge is not objective. Rather it is determined through individually constructed schema configured by external contributions of thinking and acting. Advancing claims about the contextual contribution of learning Greeno (1989) has even gone so far as to propose that the mind is an agent responding to external stimuli.

The genesis of a sociocultural view of thinking and acting, with its contextual contributions is usually attributed to Vygotsky. In the 1920s, he proposed learning to be the product of a collaborative construction of understanding between two individuals which results in it being appropriated by the learner. The nature and context of that interaction is determined by social relations and the socio-historical nature of the knowledge, the culture in which it occurs, its tools and language (Luria, 1976). The two significant elements in Vygotsky's proposition are social relationships and the socio-historical nature of knowledge. The relationship between the learner and the 'teacher' (master to novice, parent to child or teacher to student) is socially determined and influences the nature of knowledge revealed to the learner. Parents, for instance, are likely to be selective about what they reveal to their children. Knowledge which they do not think is appropriate may not be communicated or will be explained in ways determined by the parent. For example Goodnow (1990) suggests that parents may be reluctant to disclose details of family income or information about sex to children (Goodnow, 1990). Skilled workers may only reveal information to novices which they determine is appropriate. The expert may withhold knowledge to maintain the expert-novice relationships or in consideration of the novice's limited experience and understanding.

Vygotsky's second proposition was that knowledge has a socio-historical base. What is useful or useless, what should be taught and what practice is appropriate, is the product of the values, requirements and experiences within a culture of practice. This practice, which has evolved over time, is as a consequence socio-historically based. For example electricians' work and use of tools is based on the requirements of the activities in which they are engaged. Their work has a

range of tasks and a hierarchy based on complexity of application. How they use their tools is quite different from other trade workers and is differentiated by the nature of their tasks (Brown, Collins & Duguid, 1989). Issues to do with safety, for instance, have a particular significance for these workers and is part of their culture of work practice. It differentiates them from workpractice which is not in such close proximity to danger. The skills of electricians are configured by the way they carry out their tasks. It is this culturally configured practice that is passed on to novices by experts.

### **Support from other disciplines.**

Views about thinking and acting having a social and a cultural context are supported by related research. The ecological psychologist Barker proposed that setting and actions were interlinked and could not be dismissed as probabilistic (1978). His study of communities in America and the United Kingdom led to conclusions about the influence of environments upon behaviour. He concluded that environments consist of structured, highly organised phenomena, and are not passive, probabilistic arenas of events. A causal relationship exists between the environment and behaviour (Schoggen, 1992:78). These links between environment and behaviour strengthen the argument for contextual contributions to thinking and acting. These contributions are influenced by social relationships and the nature of the organisation in which the activities occur. Consequently, regardless of where the learning experiences take place need they will be influenced by the social, cultural and physical settings. The question remains whether formal and informal settings are best able to respond to these contextual requirements.

Cognitive anthropologists are also supportive of a contextual basis of learning by suggesting that cognitive properties are embedded in contexts, rather than in isolated minds (Pellissier, 1991:80). The notion of cognition being structured by activity because cognitive processes are tied to applications, or put more succinctly - that activity structures cognition - is supported in sociology (Scribner, 1985). One of the outcomes of these deliberations is to challenge the assumption that formal learning settings develop robust and transferable knowledge (Rogoff & Lave, 1984). These researchers claim that knowledge and understanding developed in informal learning settings is as transferable as those developed in formal learning settings. The need for a culture of authentic practice is being addressed in the current research and practice associated with improving the transferability of school-based learning. Most noteworthy of these requirements are cognitive apprenticeships which aim to develop expert maths and writing practice of learners (Collins, Brown & Newman, 1989) and the modelling of expert practice in reading (Palinscar and Brown; 1984) and vocational tasks (Gott, 1989). However, these approaches to fostering expert practice place a significant emphasis on the authenticity of learning experiences and as a

consequence infer that learning arrangements may be constrained by the substitute nature of activity and setting.

Recent work by Lave and Wenger (1991) has emphasised the significance of learning processes within a culture of practice and the increasingly legitimate participation by novices as they move from peripheral activities to more complex elements of practice. Two significant considerations are highlighted in a socio-cultural concept of thinking and acting. These are the role of values and the development of an identity within the culture of practice. Lave and Wenger's model of learning through legitimate peripheral participation address these issues (1991). The values associated with an identity within a culture of practice are generative. Building on Vygotsky's earlier work, these writers stress the legitimating nature of interaction between novice and expert. The expert has to legitimate the knowledge and understandings to the novice in terms of the value of their application. If knowledge cannot be legitimated it is unlikely to be accepted by the novice. However, the expert is not the sole source of contextualised knowledge. The legitimation is provided by clues in the environment such as observation of process and product, an understanding of the relationship between what a worker does and how that contributes to the totality of the occupational activity - the process and product of that activity. Equally, observation of and interaction with other learners and experts can provide strong clues. The workplace provides such concrete clues which are particularly useful for the novice, who has yet to develop strong conceptual knowledge based on experience. In an interview with a warehouse worker, during the second study (Billett, 1993), reference was made to a range of examples within the warehouse of how a pallet might be packed. It is also postulated that there is an interdependence between the elements of situated learning. For example the knowledge of the expert may be accepted or rejected by what the novices observes and experiences in the learning setting. As practice becomes legitimated the value of the culture is made explicit. It is also suggested that as practice is legitimated and the values of the culture become accepted the identity of the learner moves from being peripheral to having a significant association. Goodnow refers to the pervasive role of value and effect, stating that a novice learns not only to solve problems but also, what problems are worth solving (1990). The contextual factors mentioned above provide a range of evidence about what is and what is not valued in the culture of practice. As the significance of these external contextual factors unfolds, assumptions within instructional and learning theory are being tested and modified.

The growing acceptance of the role of external contributions to cognition is influencing deliberations within cognitive science. For example, research into expert performance has emphasised the role of domain-specific knowledge (Glaser, 1984). In addition, perception is

now being viewed as being active rather than passive, seeking out rather than being a passive receptor of external stimuli (West, Farmer & Wolff, 1991). The active process of perception is guided by a process which actively gauges and categorises using the individual's personally constructed schemata. The degree to which general processes and domain specific knowledge interacts in complex thinking is also being debated (Perkins & Salomon, 1989; Alexander & Judy, 1988). In order to support claims of the pervasiveness of a sociocultural construction of knowledge it is appropriate to examine some attributes, that are central to complex human performance, from a socio-cultural orientation. Problem-solving and the transference of learning are often associated with expert-thinking and higher-order capability. These attributes are central to conducting complex vocational tasks and provide a useful basis for explication.

### **3. TRANSFER AND PROBLEM-SOLVING**

The transfer of learning and problem-solving provide a basis for examining the sociocultural contributions to thinking and acting. Royer's (1979) concepts of 'near' and 'far' transfer are complex, yet everyday thinking processes (1979). Near transfer is between like situations and stimuli, whereas far transfer is the ability to apply previous understanding to a situation that is novel. There is some agreement that both specific knowledge and strategic or higher order thinking processes are required for far transfer (Perkins & Salomon, 1989). The question might be posed to what degree does transfer require 'knowing' in an objective sense or conversely is individually interpreted? From a sociocultural perspective knowing is individually constructed, although configured by the nature of culturally determined practice. So, although a learner will interpret a vocational task by their values and experiences these are configured by a culture of vocational practice. For example, novice hairdressers who have difficulty making conversation with customers may not value that part of the job and even attempt to avoid it. This might be because they are reticent about the task through a lack of ability or a belief developed through peers that talking to customers is not 'the done thing'. However, as the novice observes a more experienced hairdresser talking to a customer and listens to the pattern of conversation used by the expert they can begin to approximate the task. The novice might also realise the value of the activity to gain information about the desired haircut, put customers at ease and providing an expected service. Outcomes such as this provides both a basis and a means to develop the skills and values associated with those tasks. It would seem unlikely that a novice be encouraged to learn something deemed unimportant within a culture of practice.

Equally, rich indexation of individual schema is likely to assist transfer by enhancing recall allowing various aspects of vocational tasks to be re-applied to novel situations. Novice hairdressers, for example, are surrounded by artefacts and other stimuli that contribute to their

ability to talk with customers, for instance. These contextual clues include the implements they are using, previous cuts, the conversations of other hairdressers and customers. These factors make for rich indexing. They provide a library of information and assist the novice in the same way that the warehouse worker was assisted by pallets of goods, and a shopper is assisted by the organisation and visibility of products in a supermarket. Imagine shopping in a supermarket which had no products displayed but just a series of uniform written descriptions about the products (Lave, et. al., 1984) The products displayed in a supermarket and the stimuli provided by the hairdressing salon assist the indexation and activation of schema and provides clues to assist task completion in those settings. It would seem from current theorising that the representation within problem-solving and interpretation within transfer is sociocultural in orientation. This is now discussed further.

### **The sociocultural basis of problem solving and transfer.**

Being able to apply skills in novel situations distinguishes experts from novices. This facility is based on the ability to address problems using a range of cognitive attributes and strategies which promotes the possibilities of successful problem solving. Prior knowledge and understanding provides a base by which the expert is able to categorise the problem state or break down the problem into workable chunks (Chi, Feltovich & Glaser, 1981). Some parts of the novel situation will require greater attention while other, more familiar parts can be addressed more easily, even tacitly. The expert's ability to categorise the problem effectively is premised on its representation. What is common between a previous experience and the problem state is not given objectively, but is individually interpreted. Representations are organised by schema derived from previous problem solving (learning) situations. The mechanical problem faced by the novice motor mechanics will be categorised by their experience, they may not be able to determine whether it is a trivial or major problem. The expert mechanic will begin a process of categorisation based on their experience to select a course of action and will actively seek certain patterns of response from the vehicle being repaired to substantiate their choice of solution. If unexpected events occur this informs the expert that the original diagnosis was not correct or comprehensive enough, which guides further exploration and monitoring. However, the actions of the expert are not just general problem solving heuristics they are an interplay of specific knowledge, procedures, conceptual knowledge and higher order procedures. The practice is idiosyncratic, but is configured by the approach that motor mechanics use, which as stated above is guided by the tasks they have to undertake and problems they have to confront when dealing with vehicles repair and maintenance. So individual construction of understanding although idiosyncratic is configured by a culture of practice - it is not given or objectively stated.

Representation reflects the essentially idiosyncratic nature of individual experience and interpretation of that experience, configured by the sociocultural context. Schema that is more richly indexed is most likely to be accessed and is more accessible when it is linked to a physical and social context (Collins, Brown & Duguid, 1989). It is also guided by values (Goodnow, 1990). Consequently, expert mechanics respond to the physical clues provided by the engine, their individually constructed conceptual models of engines and components, and other strategies that have been useful in the past problem resolution.

A social and cultural basis for transfer is supported by Pea who refers to the appropriateness of transfer of knowledge - in which the individual's construction of knowledge and understanding determines whether transfer should and ought to take place (1987:646). A determination of appropriateness is based on overtly cultural and individual value systems. In his argument for an interpretive theory of transfer Pea makes two major claims. Firstly, transfer is selective in terms of what is appropriate to the socioculturally determined activities, tasks and thinking situations. Part of 'appropriateness' is a consideration of the worthiness of the transfer - is it worth the effort? Consequently, appropriateness requires value judgements on the part of the individual. Again, values are not given but are the product of individual and cultural attributes. Secondly, that the representation of what is common between prior knowledge and the problem state is based on the individual's culturally-determined categorisation system.

Although Greeno's notion of the mind as an agency for external stimuli (1987) would still only receive limited support within cognitive psychology it seems fair to postulate a conception of cognitive processes and structures as being more influenced by external contributions than had previously been recognised. The differentiation and significance of roles between general processes and more domain-specific forms of knowledge continues to be debated. However, it is proposed that the flesh on any cognitive structures is socioculturally determined and as a consequence the efficacy of higher order functions in utilising knowledge is guided by social and cultural influences such as values, practice and activity.

### **But what about the specific learning situation?**

A criticism usually advanced against specific learning situations is that they are restrictive, with learning being bound to that setting. Traditionally, this criticism has been advanced against learning in informal situations, such as the workplace (Resnick, 1978). Many educationalists have advanced concerns about vocational education per se - that it is too utilitarian and specific. Equally, some vocational educators are critical about learning in the workplace because of the specificity of outcomes. Ironically, this claim is now being advanced against learning in formal

settings, albeit in schools or vocational education colleges - that transfer from that type of setting is limited (Raizen, 1991). It is claimed that learning in formal settings is configured by the context of that setting - meeting the requirements of a formal educational institution. In the survey of skilled people mentioned above (Billett, 1993) many of those who acquired skills through a formal setting stated that they were more concerned with achieving the goals of the setting (passing) than learning. The respondents reported having to swot for exams, complete assignments and "meeting their marker", rather than learning what was required for the application outside of the formal learning setting.

The degree of restrictiveness of transfer ascribed to any learning arrangements should not be based on the formal or informal nature of the setting. A more useful differentiation is the ability of the setting to be generative of learning experiences that lead to robust and transferable outcomes. Such a requirement is based on the development of and interaction between the conceptual propositional base, effective procedural knowledge, conceptual knowledge and higher order processes. What is being proposed from a sociocultural perspective is that authentic learning experiences drive the learner into activities which are socioculturally meaningful, generative of proceduralisation and indexed richly to secure recall and application.

Having discussed a sociocultural basis for thinking and acting and the a basis for problems solving which is interpretative within a sociocultural context it is now appropriate to briefly consider how workplace learning can be offered to develop the range of attributes required for skilled vocational performance.

#### **4. THE EFFICACY OF WORKPLACE LEARNING**

The research and theorising stated above provides some grounds for accepting the strong support given to learning on-the-job by skilled workers. The learning process is characterised by undertaking authentic activities guided by expert practitioners situated in a culture of practice. One of the key qualities of situated learning arrangements is the emphasis on the learner initiating and approximating increasingly mature performances. Such an approach is conducive of developing the learner's conceptual and procedural base (Gott, 1989). Although it is usually proposed that procedural knowledge evolves from a propositional base (Anderson, 1982) it seems fair to speculate that the development of procedural knowledge extends the propositional and conceptual base.

However, the efficacy of these arrangements cannot be guaranteed. For such arrangements to be successful, support mechanisms and structure is required especially to assist with the development of conceptual knowledge, which may not always be visible or accessible through

workplace learning. While it would be unrealistic within the scope of this article to explore the general efficacy of situated learning it is appropriate to advance some indications of good practice that the two studies revealed and which are supported in the literature. Lave's study of tailors' apprentices provided a framework to examine the use of the workplace as a learning setting (1977 and 1990). These principles were also evaluated in the literature on cognitive apprenticeships (Collins, Brown & Newman, 1989). Significantly, the responses of skilled workers about how they acquired skills supported these concepts (Billett, 1992 & 1993). These concepts are briefly outlined below.

What it being suggested is that learning situated in authentic settings has the potential to provide rich experiences and if those experiences are accessible to the learner they should provide the range of knowledge and attributes required for expert performance.

Situated learning can provide both activity and agency - socioculturally authentic activities and a range of peer and expert models plus a physical environment which is conducive of rich indexicality. Workplace learning arrangements provide access to a authentic vocational activities which allow the learner to experience both the process and product of their activities. The emphasis being placed on the learner encourages self-initiation and regulation through engagement in relevant tasks which are purposeful in goal achievement (Stevenson & McKavanagh, 1991). Task completion can be mediated by access to an expert or a range of experts and other learners, by which comparisons of the learner's own performance can be made. The extended nature of workplace learning allows sufficient time for the learner to become orientated and experience cognitive developing activities.

The on-job learning processes should be modelled on the use of observation, coaching and increasing autonomy of practice as characterised by the traditional apprenticeship method of learning (Collins, Brown & Newman, 1989). This approach to guided learning has the ability to develop conceptual models of tasks, procedural knowledge and extend the propositional base which is generative of deep conceptual understandings. It would seem that learning in the workplace has a significant potential as learning mode if the recommendations stated above about the arrangement of learning experiences are considered.

This paper has examined a concept of learning which has particular implications for the development of vocational expertise. Rather than dismissing learning in the workplace as informal and lacking the intentional structure that is provided in formal vocational education settings, the attributes of workplace learning should be considered as a viable option for skill

development and one that is highly accessible. It may be appropriate to provide structure to enhance this informal type of learning setting. Equally, it is suggested that learning arrangements in formal vocational settings may be enhanced by considering how best to access the social and cultural aspects of vocational skills.

## References

- Alexander, P.A. & Judy, J.E. (1988). The interaction of Domain Specific and Strategic Knowledge in Academic Performance. *Review of Educational Research*, 58 (4) 375-404.
- Anderson, J. R. (1982). Acquisition of Cognitive Skill. *Psychological Review*, 89(4), 369-406.
- Barker, R.(1978). *Habitats, Environments and Human Behaviour*. San Francisco: Jossey-Bass Publishers.
- Billett, S.R. (1992). Authenticating learning - learning in the workplace.A Paper Presented at the 1992 AARE & NZARE Joint Conference "Educational Research: Discipline and Diversity" Deakin University, Geelong, Victoria, Australia. 22-26 November 1992.
- Billett, S.R. (1993). Evaluating modes of skill acquisition. Centre for Skill Formation Research and Development. Griffith University: Brisbane, Australia.
- Brown, J.S., Collins, A., & Duguid, P. (1989). Situated Cognition and the Culture of Learning. *Educational Researcher*, V.18,(1), 32-34.
- Bruner, J. S. (1966). On cognitive growth II. in J.S. Bruner, R.R. Oliver, & P. M. Greenfield (eds), *Studies in cognitive growth*. 30-67. New York: Wiley.
- Chi A.T.H., Feltovich P.J., & Glaser, R. (1981). Categorisation and representation of physics problems by experts and novices. *Cognitive Science*, 5, 121-152.
- Collins, A., Brown J. S., & Newman, S. E. (1989). Cognitive Apprenticeship: Teaching the Crafts of Reading, Writing and Mathematics. In L.B. Resnick (ed) *Knowledge, Learning and Instruction, Essays in honour of Robert Glaser*. pp.453-494. Hillsdale, N.J: Erlbaum & Associates.
- Glaser, R. (1984). Education and Thinking - the role of knowledge. *American Psychologist*, 39,(2), 93-104.
- Glaser, R. (1989). Expertise and learning: How do we think about knowledge structures now that we have discovered knowledge structures? In D. Klahr & K. Kotovsky (ed) *Complex Information Processing*. Hillsdale, N.J: Erlbaum & Associates.
- Gott, S. (1989). Apprenticeship Instruction for Real-World Tasks: The Coordination of Procedures, Mental Models, and Strategies. in Rothkopf, E. Z. (ed) *Review of Research in Education*, Washington, DC: American Educational Research Association.
- Goodnow, J.J (1990). The socialisation of cognition: what's involved?. *Cultural Psychology*. (ed) Stigler, J.W., Shweder, R.A., & Herdt, G. pp 259-86. Cambridge: Cambridge University Press.
- Greeno, J.G (1989). A Perspective on Thinking. *American Psychologist*, 44 (2) 134-141.
- Lave, J. (1977). Tailor-made experiments and evaluating the intellectual consequences of Apprenticeship Training. *Quarterly Newsletter of Institute for Comparative Human Development*, 1, 1-3.
- Lave, J., Murtaugh, M., & de la Roche, O. (1984). The dialectic of arithmetic in grocery shopping, in B. Rogoff and J. Lave (eds) *Everyday Cognition: Its development in Social Context*. Cambridge: Harvard University Press
- Lave, J. (1990). The culture of acquisition and the practice of understanding. *Cultural Psychology*. (ed) Stigler, J.W., Shweder, R.A., & Herdt, G. pp 259-86. Cambridge: Cambridge University Press.
- Lave, J. & Wenger, E. (1991). *Situated learning - legitimate peripheral participation*. Cambridge: Cambridge

University Press.

- Luria, A. R. (1976). *Cognitive Development: its cultural and social foundations*. Cambridge: Harvard University Press.
- Palinscar, A. S. & Brown, A. L. (1984). Reciprocal Teaching of Comprehension - Fostering and Comprehension - Monitoring Activities. *Cognition and Instruction, 1*(2), 117-175.
- Pea, R.D. (1987). Socializing the knowledge transfer problem. *International Journal of Educational Research, 11*(6), 639-663.
- Pelissier, C. (1991). The Anthropology of Teaching and Learning. *Annual Review of Anthropology, 20*, 75-95
- Perkins, D.N. & Salomon, G. (1989). Are Cognitive Skills Context Bound? *Educational Researcher*, January - February.
- Raizen, S. A. (1991). *Learning and Work: the research base*. OECD 1991
- Resnick, L. (1987). Learning In School and Out. in *Educational Researcher, 16*(9) 13-20.
- Rogoff, B., & Lave, J. (eds) (1984). *Everyday Cognition: Its development in social context*. Cambridge, Mass: Harvard University Press.
- Rogoff, B. (1990). *Apprenticeship in thinking - Cognitive Development in Social Context*. New York: Oxford University Press.
- Royer, J. M. (1979). Theories of the Transfer of Learning. *Educational Psychologist, 14*, 53-69.
- Schoggen, P. (1992). Roger Garlock Barker (1903-1990). *American Psychologist, 47*(1) 77-78.
- Scribner, S. (1985). Knowledge at Work. *Anthropology and Education Quarterly, 16*, 199-206.
- Stevenson, J. C. & McKavanagh, C. W. (1991). Cognitive Structures Developed in TAFE Classes. Paper presented at the *1991 Conference of the Australian Association for Research in Education*. (Gold Coast) November 1991.
- West, C., Farmer, J. & Wolff, P. (1991). *Instructional Design - implications from cognitive science*. Englewood Cliffs, NJ: Prentice Hall.

## Notes.

Scaffolding based on Vygotsy's zone of proximal development

As Rogoff and Lave (1984) have reported from their cross-cultural studies there appears to be little in the differentiation of the general ability of either formal or formal settings to produce robust and transferable knowledge.

\* need to determine the qualities that are useful in workplace learning to assist with development of arrangements to maximise the learning process.

\* thinking and acting is not given but the product of individual determination and interpretation, yet as this learning is configured within a sociocultural context a coherence provided by a culture of practice guides thinking and acting in a more rather than less consistent way.

\* as the notion of learning being influenced by external factors unfolds it becomes important to examine the quality of those external influences.