

# VET PROVISIONS FOR LEARNING IN THE CHANGING ROAD TRANSPORT INDUSTRY

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## **Abstract**

The modern workplace can be characterised by constant change, especially where new technologies change the ways in which individuals participate in work, often making the task of learning more difficult (Billett, 2001) because of “work practices requiring greater discretion in decision making” (p.48). However, one of the greatest impacts generated by technology in the workplace has been the shift away from ‘manual’ systems to highly symbolic analytical activity systems (Martin & Scribner, 1991; Berryman, 1993), where there is an increasing reliance on workers to access and manipulate symbols such as data, plans, audio, and visual representations often associated with computerisation (Stevenson, 2003) for workplace performance.

An issue confronting road transport operators (i.e. truck drivers) is the introduction of new technology into its operations, which is changing the way information and knowledge is presented to the driver, from the ‘old’ technology where it was explicit, to the ‘new’ technology where knowledge is abstract, remote, and ‘hidden’. Although the recent introduction of computerised automated systems, such as the automatic changing gear box, has reduced the physical effort required to change gears and drive the truck, the technology has made work performance more, rather than less, complicated because deeper levels of understanding are required both in the abstract and symbolic knowledge needed, and the overall understanding of systems interrelational dependencies.

The road transport sector is an example of an area in which technology has changed the nature of work practice and placed additional demands on workers to ‘re-skill’. How industry and the vocational education and training (VET) sector respond to the challenges of driver education given these technological innovations is a key consideration.

This paper focuses on some issues confronting the VET practices in the road transport sectors, and synthesises the efficacies of some of the key workplace pedagogies, including the learning methods and preferences of workers confronted by technological changes in the workplace.

## **Introduction - Learning and working in the road transport sector**

Drawing on a study that was designed to understand and elaborate how learners who work in circumstances that might be described as being relatively socially isolated come to further develop their working knowledge, this paper reports on the findings of the

survey phase of the study and the subsequent implications for VET within the road transport sector.

There are important conceptual and procedural imperatives motivating this aim. Conceptually, much of the research into the social contributions to and bases of learning have focused on learners engaged in learning related activities with others and more experienced counterparts, such as in educational institutions or workplaces where other learners and experts are close by. Indeed, much of this research has emphasised the close guidance provided by more expert or experienced partners (e.g. teachers, parents, supervisors, more skilled workers). Much less emphasis has been given to learners who think, act, and learn in circumstances that do not afford close guidance of such experts, or even peers as learners. This represents salient conceptual terrain as increasingly valuable knowledge is held to arise socially and through close or proximal encounters with social partners who already have access to that knowledge. In particular, the issue of how socially-isolated learners develop understanding of knowledge, and in particular, deep conceptual knowledge that is 'hidden' stands as a challenge to social learning theorists.

There are also important procedural concerns here. Many, perhaps most workers for instance, work in and learn in these kinds of circumstances. So, beyond understanding how the social genesis of learning arises through these processes, there are also important procedural concerns. These include identifying how best the learning of those who are relatively socially isolated might best progress, particularly with their constructing knowledge that is 'hidden' by technology and therefore hard to learn.

The context for the practical investigation discussed here, is the development of road transport workers' conceptual knowledge through understanding the learning methods and preferences as indicated by the survey participants. Road transport operators often work alone yet are faced with learning to accommodate and respond to new work challenges and ways of working. Increasingly, these workers are required to engage with and understand work knowledge that is represented symbolically through display systems and requires capacities that are distinct from an earlier generation of road transport workers. Indeed the introduction technological advancements, such as computerised and automated systems in a variety of transport applications, has increased the emphasis on human cognitive work (Dekker, 2000). Moreover, given the relative social isolation that comprises their work, it is important to understand how the personal and social (i.e. internal and external) aspects of development interact in their learning in order to improve their learning experiences. Central to this paper is how VET is used for socially isolated road transport operators to learn new types of conceptual knowledge in view of recent technological innovations.

## **Literature review**

Paavola, Lipponen, & Hakkarainen's (2004) observation that "conceptually well-founded approaches to knowledge-creation are needed to help people make the epistemological and ontological shifts required to participate productively in an advanced knowledge society" (p.573) is pertinent to this study because it motivates a response that, while

conceptually well-founded approaches to knowledge creation are needed, attempts to integrate different approaches to knowledge development through the interaction of both social and individual contributions to learning has resulted in a type of “consensus approach” in order to avoid a “drastic conflict between the two approaches” (p.558). In recent times, attempts to explain the multidimensional problem of learning have resulted in the rise of constructivist theories which have emphasised that knowledge is ‘distributed or embedded in activity, i.e. not in the mind but in situational understanding and embodied in tools of cultural practice’ (Bereiter, 2002). Constructivist epistemology, conversely, implies that the development of new knowledge is a human construction where existing knowledge is used to construct new knowledge. Grounded in the writings of Vygotsky, sociocultural constructivist perspectives on learning emphasise the ‘interdependence of social and individual processes in the coconstruction of knowledge’ (John-Steiner & Mahn, 1996, p.191), the acquisition of intellectual skills through social interaction and social participation (Tillema & Orland-Barak, 2006; Wenger, 1998; Palincsar, 1998), the co-participation of individual and social practice (Packer & Goicoechea, 2000; Billett, 2004), and the setting of activity and historical change (Brown, Collins, & Duguid, 1989). According to Vygotsky (1978) cognitive growth is socially constructed because higher order knowledge has a social genesis and is the product of the cultural history of humankind (Silven, 2002). On the other hand, individual (psychological) constructivism is concerned with how ‘individuals make sense of their world, based on individual knowledge, beliefs, self-concept or identity’ (Woolfolk & Margetts, 2007). From this perspective, universal development changes ‘are believed to come about through a general cognitive mechanism for processing information’ (Silven, 2002 p.346). Through a sequence of stage-like changes into higher cognitive levels, Silven (2002) summarises the development of knowledge as being a series of extensive domain-general changes which are ‘regulated by the process of assimilating information from the environment to schemas/cognitive structures and accommodating them into external reality’ (p.346).

Indeed, reconciling the epistemological and the ontological perspectives on learning and development has generated much debate with an emerging consensus that both perspectives are needed (Barab & Plucker, 2002; Packer & Goicoechea, 2000). However, rather than adopting a “consensus” approach to knowledge development, it is proposed here that learning occurs in a dynamic system that may at times ‘overlap’ between the individual and sociocultural approaches, and that learning is a result of the integration of different approaches through participation in a community and through specific social practices that are culturally and historically situated (Packer & Goicoechea, 2000). Rather than identifying similarities in the two different approaches to learning, it is postulated that learning and knowledge development are constantly evolving and are the result of the interaction of the individual, the physical environment, and the socio-cultural context (Barab & Plucker, 2002). Although sociocultural and individual contributions to learning are fundamentally different, they may share commonalities that are dynamic in nature and therefore constantly changing in response to individual, situational, and social influences. Learning may be characterised by a dynamic and fluid interaction of the two different approaches in which the commonalities are combined to maximise learning and knowledge development.

Recent research has focused on the relational interdependence between social and individual agency in the learning through out working life (Billett, 2006), the impact of ontology on learning (Packer & Goicoechea, 2000), appropriation and ontology in identifying compatibility between cognitive and sociocultural contributions to adult learning and development (Billett, 2005), and bridging sociocultural and cognitive theorising through situated learning and Cultural Historical Activity Theory (CHAT) (Sawchuk, 2006). It follows that developing an integrated approach in the construction of knowledge, learning, and outcomes of learning is important because it not only offers a way of advancing or understanding of learning, but also provides a framework for unifying both the individual and social contributions to learning and defining the relation interdependencies in these dynamic learning systems.

Given this recent research, the relational interdependence between social and physical world (i.e. external) and individual (i.e. internal) agency is seen to be a key factor in the development of adult learners for a number of reasons in the changing nature of work practice arising from such factors as: (i) the introduction of computerised technologies, (ii) demographic changes (e.g. ageing populations), (iii) work participation changes (e.g. greater number of women filling traditionally male dominated work roles), (iv) work performance requirements (e.g. workers are expected to be 'multi-skilled), and (v) working environment changes (e.g. working at home or in socially/geographically isolated environments). These changing concepts and requirements of work have an impact, not only on the types of work that will be available, but also on the participation in work, the composition of the workforce, and the requirements of work performance (Billett, 2005).

The road transport sector is an example of an area in which the changing nature of work practice has transformed the industry and placed additional demands on workers to 're-skill'. This investigation focuses on some issues confronting the road transport sector, and in particular the challenges facing truck drivers in view of the rapidly changing social, technological and economic conditions confronting society.

### **Aim of the investigation**

The aim of this investigation is to understand how human learning of socially derived but potentially hard to access knowledge proceeds in circumstances of relative isolation from the experts who are presumed to be the key source of that knowledge in many contemporary accounts of learning. This purpose will be exercised through the development of an integrated learning approach of knowledge development in road transport. This will comprise accounting for an interdependence of both social (i.e. sociocultural) and individual processes (i.e. cognitive). The investigation will focus on three key areas in the construction of knowledge; (i) 'hidden' or opaque conceptual knowledge, (ii) the impact of new and changing technologies in the development of this knowledge through the integration of new information into memory and the restructuring of existing knowledge representations (i.e. conceptual change) (Sinatra, 2005), and (iii) the ability of workers to learn and develop this knowledge in view of the fact they are

often socially isolated, often unable to access expert guidance when confronted by new and changing technologies. These three areas of investigation reflect the complex interrelations between the psychological, technological, social, and organisational factors impacting on the learning of workers in road transport.

### **Research question**

The study seeks to investigate the issues in driver education relating to skills, knowledge, and attitude development to address the recent automotive technological advances and the changing nature of the road transport industry. The following question guides the investigation;

1. What learning individual and social methods and preferences are effective for road transport workers and how do both individual *and* social contributions integrate with each other to support and strengthen learning and conceptual development in the workplace?

This question is exercised through a methodological approach that is previewed below.

### **Research methods and procedures**

The research methodology was designed to gather validated data about what learning approaches are currently employed, what strategies are working the best, and what strategies that are not being used that could be employed to provide better learning opportunities. Specifically, the research methodology aimed to identify the effectiveness of different learning approaches (i.e. both sociocultural and individual) on the development of conceptual (i.e. 'hidden') knowledge on isolated workers. This data was elicited through a survey (n=65) that consisted of 19 multi-choice questions that are designed to identify how the drivers' learn and develop knowledge in an increasingly complex work environment. The survey focused on the development of conceptual knowledge by individuals that work in relative social isolation without the benefit of expert or peer assisted guidance based, and is on the research question: (i) Individual cognitive learning approaches (e.g. self taught / self directed, reading, trial and error, moment by moment engagement, work participation), (ii) Socio-cultural learning approaches (e.g. guided learning, formal/informal training, modelling, coaching, mentoring), and (iii) individual *and* social contributions integrate with each other to support and strengthen learning and conceptual development in the workplace.

### **Methods**

A series of 19 learning methods were presented to the survey participants (truck drivers n=65) and they were asked whether they agreed or disagreed with the question "Do you think the following learning methods would be effective in developing and maintaining your workplace skills as a truck driver?". The learning methods and preferences included: 'coaching', 'mentoring', 'feedback', 'social interaction', 'questions', 'analogies', 'diagrams', 'self taught', 'observing and listening', 'everyday workplace

activities', 'on-the-job', 'trial and error', 'peer assisted', 'hands-on technology training programs', 'classroom technology training programs', 'computerised driver simulator', 'regular truck and industry updates', 'regular internal testing', and 'annual independent formal driver evaluations'.

### **Significance of the investigation**

The significance of this study is to identify ways in which conceptual knowledge and skills might best be learned by those who think, act, and learn in circumstances of relative social isolation. Although the context here is on heavy road transport operators in view of the technological changes taking place and the isolated environment in which many of them work, it is anticipated the application of the findings will be far wider, especial in the development of VET courses that reflect the changing requirements of modern technologically influenced industries such as road transport. Additionally, developing an integrated approach to knowledge development that combines aspects of individual and social contributions to enhance individuals' learning practices or personal epistemologies is also a central aim of the investigation.

However, the knowledge required for the safe and efficient work, including responding to new challenges as is required in the operation of modern trucks is often 'hidden' within the computerised systems embedded throughout the various components of the truck, and which is displayed to the driver via the Driver Information Display (DID) in a highly abstract and symbolic format. Moreover, there is a vast amount of this information available, not all of which is immediately necessary for the operation of the vehicle. So not only does the driver have to decipher and understand this information, but also filter out unnecessary information, whilst prioritising the necessary information. The significance here is firstly; the development of conceptual knowledge in problem solving as a result of technology rendering information abstract, symbolic, and 'remote' from the learner and therefore more intellectually demanding. Further, because learners are confronted by technologies, concepts, and procedures outside their existing domains of expertise, much of the learning will be new learning thereby increasing initial cognitive loads and demands on concentration and focus required to master the new systems and procedures. Furthermore, most of the knowledge and skills required are 'hidden' because, within the confines of the truck cabin, activity is difficult for the learner to observe, with most learning occurring in isolation without the benefits of expert guidance and supervision. This knowledge is also 'hidden' in a cognitive sense because it is presented to the driver in a highly abstract and symbolic format requiring a deep conceptual knowledge of computers and systems, which many would never have been exposed to.

### **Findings and discussion**

The survey data from the respondents (n=65) was analysed and the findings interpreted and presented in Table 1. Table 1 consists of 19 different learning methods that the participants' were asked to rate on a Likert scale from 'strongly agree', 'agree', 'neither agree or disagree', 'disagree', and 'strongly disagree'. The table consists of four categories of learning methods; (i) guided learning, (ii) feedback, (iii) structured learning, and (iv)

unstructured learning methods. Guided learning strategies included such methods as; coaching, mentoring, questioning, analogies, peer assisted, and diagrams (Billett 2001). Other strategies such as ‘feedback’ have also been included which have proven to be effective in other learning situations (Hattie & Timperley 2007; Vollmeyer & Rheinberg 2005). Additionally, unstructured learning methods such as ;self taught, trial and error, and every day workplace activities are also included, as are formal learning methods such as; hands-on technology training programs, classroom technology training programs, computerised driver simulator, regular truck and industry updates, regular internal testing, and annual independent formal driver evaluations

**Table 1 Learning methods findings and ranking**

| <b>Agree</b>                         | <b>Disagree</b>                      |
|--------------------------------------|--------------------------------------|
| 1 = 94% OJT                          | 1 38% Trial & error                  |
| 1 = 94% Questions                    | 2 23% Self taught                    |
| 2 91% Social interaction             | 3 16% Classroom training             |
| 3 89% Observing & listening          | 4 14% Driving simulator              |
| 4 86% Everyday workplace activities  | 5 14% Regular internal testing       |
| 4 86% Regular truck industry updates | 6 13% Diagrams                       |
| 5 83% Hands on technology training   | 7 11% Independent driver evaluations |
| 6 78% Feedback                       | 8 9% Analogies                       |
| 7 78% Peer assisted                  | 9 = 5% Peer assisted                 |
| 8 67% Mentoring                      | 9 = 5% Regular industry updates      |
| 8 = 67% Formal driver evaluations    | 10 = 3% Mentoring                    |
| 9 61% Coaching                       | 10= 3% Coaching                      |
| 10 59% Analogies                     | 10= 3% OJT                           |
| 11 53% Regular internal testing      | 11= 2% Feedback                      |
| 12 52% Driving simulator             | 11= 2% Everyday workplace activities |
| 13 50% Classroom training            | 16 0% Social interaction             |
| 14 45% Diagrams                      | 17 0% Questions                      |
| 15 39% Self Taught                   | 18 0% Hands-on technology training   |
| 16 38% Trial & error                 | 19 0% Observing & listening          |

Table 1 indicates that the guided learning strategy of ‘questioning’ (94%) and the unstructured learning method of ‘on-the-job’ learning (94%) received the highest score from the participants. This was closely followed by ‘social interaction’ (91%), ‘observing and listening’ (89%), ‘everyday workplace activities’ (86%), ‘regular truck industry updates’ (86%), ‘hands-on technology training’ (83%), ‘feedback’ (78%), and ‘peer assisted’(78%).Table 1 also suggests that the least effective methods of learning were; ‘trial and error’ (38%), ‘self taught’ (23%) and ‘classroom training’ (16%).

Overall, the response to the survey indicated that the most effective learning methods used in developing and maintaining truck drivers' workplace skills involved a combination of on-the-job training, social interaction, questioning, and observing and listening. This reflects the multidimensional approach to learning with an emphasis on the social contributions to knowledge development. This is evident by the high importance the participants' placed on social interaction in the learning process. Indeed, four of the top five responses (questioning, social interaction, observing and listening, and everyday workplace activities) involved social interaction to some degree. This signifies that although the drivers' spend most of the working day in social isolation without social contact, there are times when direct social contact is important for learning development. Additionally, all of the learning methods (structured, unstructured, feedback, and guided learning) were represented with significant scores above 75%. This indicates that developing and maintaining workplace knowledge involves a multidimensional approach using combinations of different types of learning including the combination of both individual and social approaches.

### **Conclusion**

The trends that are emerging from the data indicate that, although learners may be working in socially isolated circumstances, there is a need for social interaction combined with structured and unstructured learning methods. The complex and dynamic interactions and interdependencies of these learning approaches reflect the continually changing nature of learning in the workplace and the need for flexible construction of meaningful knowledge driven by new technology in a changing workplace. How both individual (cognitive), and social (sociocultural) approaches to learning interact and integrate with each other in the development of 'hidden' knowledge is central to this study. However, how VET responds to the need for aligning effective workplace pedagogies with changing demographic, industry, and workplace requirements will be a challenge for the future.

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