Learning through practice: beyond informal and towards a framework for learning through practice

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1 Learning through work

The learning of occupations through work is a central, and perhaps the most salient, element of technical and vocational education and training (TVET). Across human history, learning through practice (for example, of the skills needed for work) has been the single most important process for developing occupational competence and it has served both societal and personal needs well. In Europe, for over a millennium prior to industrialization, the learning of occupations typically occurred in the family, or in small businesses which served and met the needs of their communities. Even earlier, similar processes were enacted in Mesopotamia, Hellenic Greece and Imperial China, with the latter offering the most enduring example of the salience of learning through practice across five millennia. However, since industrialization and the formation of modern nation-states, and with the introduction of mass schooling, vocational and higher education systems, the standing and outcomes of practice-based learning experiences have been denigrated.

Within educational discourse, learning in workplaces is often described as being an informal or ad hoc process, and its outcomes are seen as concrete and piecemeal. Yet, such characterizations are incorrect, imprecise and erroneous. Indeed, current governmental, societal and personal concerns about the applicability of what is learnt through educational provision are now warranting a reappraisal of the legitimacy and worth of learning through practice. The implications here extend to TVET institutions and programmes. Nevertheless, such reconsideration needs to be informed by accounts about the processes and outcomes of learning through practice in ways not premised upon or beholding to the dominant and unhelpful discourse of 'schooling'. Indeed, to counter the legacy of this discourse, there is now a need for a science of learning through practice to be advanced, if for no other reason than to re-legitimize this process of learning occupational capacities.

By drawing on theoretical advances and recent empirical work, this paper offers some bases for such an account, and shows how it is enacted through elements of the curriculum and pedagogic and personal epistemological practices. These considerations are well aligned to UNESCO's goals for TVET, about engaging

students and workers with changing work and societal imperatives, such as effective transition from school to work, developing occupational capacities, and sustaining and developing further those capacities across lengthening working lives.

The case here progresses through considerations of the contributions of practice experiences, how they might be considered, the potency and limitations of learning through work, and how these experiences can be conceptualized and advanced to secure robust or adaptive occupational learning. This account delineates and identifies premises for curriculum, pedagogy and personal epistemology that are likely to support effective learning through practice. That is, it considers how experiences for TVET students need to be organized (in other words a curriculum), enriched through engagement with others and effective learning experiences (i.e.in other words, pedagogy), and how learners need to engage to secure these outcomes (in their personal epistemologies). The paper concludes by outlining some of the key conceptual and procedural challenges that confront the development of a science of learning through practice. Finally, these ideas are taken forward to advise on how such considerations should inform policy national and global TVET policy agendas.

2 The contributions of learning through practice

Over time, learning through practice (in other words, learning in and through the circumstances of work) has made the most significant contribution to what is encompassed by TVET. In short, learning through practice (in work) stands as the most common, pervasive and salient provision of learning for occupations across human history. It has largely met the ongoing capacities required for sustaining the human needs for nutrition, shelter and health care. In these ways alone it has advanced cultural and economic development across human history and across seemingly all cultures (Billett, 2010). It certainly warrants a more worthy, informed, clearly defined and legitimate place within TVET, than being described as 'informal'. Hence, when

considering learning through work activities and in workplaces as part of the TVET provision, it is necessary to describe and characterise them precisely and accurately.

In comparison, the provisions of programs of intentional learning in vocational and higher education institutions are relatively recent. In an era of mass and comprehensive education, there is an understandable tendency to forget that the most common, pervasive and salient means for developing individuals' capacities for secure economic independence and contributing to societal and cultural needs are learnt in practice. Indeed, the discourse of schooling often obscures a consideration of learning outside of educational institutions. In European and Scandinavian countries, the advent of industrialization and the formation of modern nation-states prompted the need for a mass provision of education for occupations, because of the disruption to a system of skill development in home or family businesses that had then lasted at least a millennium (Greinhart, 2002). In China, for instance, almost two millennia before the era of Henry Ford, highly developed, organized and regulated processes of production and services met the needs of the country's vast population. These processes were all premised upon the development of specific occupational tasks within family or family-owned small enterprises or in community-based state-organized enterprises (Barbieri-Low, 2007; Gowlland, 2012). Similar processes are reported as occurring in ancient Mesopotamia (Finch and Crunkilton, 1992) and Greece (Lodge, 1947).

Moreover, even today this approach to occupational development remains a key element of TVET. It is enacted explicitly through apprenticeship-type arrangements, and is also how workers learn at work throughout across their lengthening working lives (Dymock et al., 2009). In contemporary apprenticeship models being enacted in western countries, the practice-based component is usually of far greater duration than the time apprentices are in educational institutions (Deissinger, 2002; Deissinger and Hellwig, 2005). Few would argue that only the college or school-based components of apprenticeships generate the knowledge required for skilled work, or that work settings are merely sites to apply and practise what has been learnt in educational settings. There is also growing evidence of the potency of practice-based experiences for learning occupational capacities across the range of kinds and categories of work (Billett, 2010; Cooke, Irby and O'Brien, 2010). Therefore,

more than being an artefact of the past, learning through practice is probably still the preeminent form of the initial and ongoing development of individuals' skills across a range of nations and cultures.

Evidence suggests that the authentic occupational activities individuals engage in work settings, and their interactions during them, generate both situation-specific and more broadly applicable occupational knowledge (procedures, concepts and dispositions) (Billett, 1994). That is, these experiences are not restricted to learning the occupational capacities needed in particular workplace settings, but also skills that can also be applied elsewhere. Through engaging in work activities, individuals can secure the conceptual, procedural and dispositional occupational knowledge required for their work, including capacities that are adaptable to other circumstances where that occupation is practised (Billett, 2001b). These outcomes are important, as governmental and public concerns about the efficacy of educational programmes mean it is now a common requirement that practice-based experiences be included in these programmes (DEST, 2002; DUUS, 2008).

The knowledge learnt in those programmes does not always adapt (or transfer) well to the world of practice. As a result, workplace learning experiences are now seen as being essential to develop the kinds of skills required for entry into, and competent performance in, students' selected occupations.

Beyond this current interest, the important of learning through practice to contemporary TVET is founded on at least three other concerns. Firstly, for many occupations there are limited or no institutionalized TVET provision (examples are coal mining and care of the elderly). For these occupations, workplaces remain the principal, and potentially the only site, through which to learn work-related capacities. Hence, the contributions of practice settings remain central to workers' initial development of occupational capacities.

Secondly, beyond the initial preparation of occupational capacities, which is the focus of many TVET resources and programmes, there is a need for the ongoing learning required to maintain employability and progress throughout people's working lives. For most workers, learning across their working lives is likely to be based on learning through their everyday work, engaging in new tasks at work, and working with others (Billett, 2001b).This on-going learning through practice is inevitable, and it is

important to sustain employability. It is inevitable because workers of all kinds are required to address new tasks and requirements and be able to respond effectively to them (Billett, 1994). This ongoing learning is increasingly important because of the constant changes in requirements for effective occupational practice, and because increasing numbers of people change occupations in the course of their working lives (Billett, 2006; Noon and Blyton, 1977).

Thirdly, there are growing concerns globally about older workers sustaining their employability across their working lives. To maintain their employability, they need to update their skills regularly, and much of this learning needs to occur in work settings. So, as TVET provisions are seeking to find ways of addressing older workers' requirements to sustain their employability, considerations of learning through practice may well emerge as being the most relevant and pertinent kinds of experience for these workers.

In sum, the provision of learning through work is central to TVET. In large part, the goals for, access to and opportunities for securing the kinds of learning that are the focus of TVET policies and practices can be realized through practice-based learning experiences. Moreover, as noted, there is now renewed interest in these kinds of experiences for both initial occupational preparation and ongoing development across individuals' working lives. So as well as being essential for young people entering working life, and in preparation for their selected occupations at all levels of tertiary education, these experiences are central to the ongoing learning that will sustain their employability, permit them to transfer to new forms of work, and also sustain them across lengthening working lives.

3 Going beyond 'informal'

When referring to and describing learning through practice, it is helpful to use conceptions that describe its contributions and limitations on its own terms, and not those from the discourse of schooling. Despite their ongoing contributions to individuals' learning, practice-based experiences are often considered from the

perspective of what occurs in educational institutions and programs. This emphasis leads to learning through work being seen in restrictive and even negative ways, which weakens its standing and limits its potential. Perhaps the most common terms used to describe this kind of learning are 'informal' (Eraut, 2004; Marsick and Watkins, 1990) and 'non-formal' (Smith and Clayton, 2009). Both terms are deeply unhelpful in understanding learning through work. They are imprecise and erroneous (Billett, 2002), and they fail to do justice to, legitimate or advance a form of learning support that is central to TVET's goals and practices. Indeed, there are at least three bases on which we can criticize the use of the term 'informal' (Billett, 2002).

Firstly, to describe something by what is not (that is, informal or non-formal activity is seen primarily in contrast within educational institutions) is unhelpful in characterizing and appraising it effectively. In the field of education, 'formal' is a term associated with what happens in educational institutions and their programmes and settings. It suggests a preference for such settings, which tends to shape judgements about learning experiences. In reality, it is not helpful to privilege uncritically the process and outcomes of programmes that take place in educational institutions. This does little to provide an informed view about the worth of different kinds of setting for learning, such as workplaces. Certainly, such terms and perspectives fail to capture the qualities of learning through practice, and as a result, this kind of discourse cannot generate adequate advice about how it might best be enacted.

Secondly, it is not the case that most workplace learning lacks structure and organization (i.e. is realized through ad hoc experiences). Rather, the norms and practices of the workplace shape the experiences (that is, the activities and interactions) that take place within them. This structuring is central to the potential of workplaces as learning environments. This includes how these norms and practices serve to mediate opportunities for learning, and to whom. So, far from being informal, the formalities of workplace settings are central to understanding them as learning environments, to assessing their effectiveness, and to determining how their potential can be realized.

Thirdly, when an account of learning potential focuses on physical and social settings (in this context, the contrast between workplaces and – educational settings), this tends to underplay the role of the student. It is important to give full weight to the

contributions that individuals make to their own learning, through the capacities, interests, subjectivities and internationalities they possess and exercise. Although the schooling discourse often unhelpfully positions learners as students, and perceives learning processes as being a form of transmission of knowledge information, this is hardly accurate. Indeed, it is quite inappropriate in considering learning processes of all kinds.

Consequently, given its significant contribution to TVET's goals and practices, it is necessary to develop a far more fully elaborated account of how learning through practice occurs. A simple characterization of such learning as informal is neither adequate nor helpful. Instead, there is a need to know about learning processes in the circumstances of work, and how they can be enhanced to help meet the needs of young and older individuals: when initially learning an occupation, in sustaining their employability, and/or developing and sustaining a sense of vocation across their working lives. The central proposal of this paper is that TVET warrants a science of learning through practice, and that such a science would assist it in realizing these goals. Some beginnings of this task are set out here.

4 The potentials and limitations of learning through practice

As was noted earlier, public, governmental and scientific interests in learning through practice activities (in the course of work) and in practice settings (such as workplaces) have grown recently in response to at least three distinct concerns.

Firstly, concerns are often expressed by global agencies such as the Organisation for Economic Co-operation and Development (OECD), governments, employers and professional associations about the applicability and/or adaptability of what is learnt in educational institutions. A common call is for workplace experiences to make up a greater component of programmes that are preparing students for occupational outcomes.

Secondly, there is a growing dissatisfaction with accounts of learning that emphasize cognitive processes, as they fail to account for social contributions to both learning and the utilization of what is learnt in settings other than where it is learnt. Hence, it seems crucial to acknowledge the worth and utilize contributions of work and work settings.

Thirdly, the need to account for situated contributions to cognition and performance requirements means it is important to consider the circumstances where individuals engage in occupational activities and interactions. Here, these concerns are used to discuss how practice-based learning experiences and settings can contribute.

4.1 Learning through practice and in practice settings

Contemporary accounts of human learning are opening up considerations of the experiences that promote learning both in and outside educational institutions. These accounts emphasize the ongoing process of interactions between individuals, and between individuals and their social and physical worlds generally, and they do not make qualitative distinctions between particular settings for learning, or necessarily privilege one setting over another. Instead, the focus is on the kinds of activity and interaction that these settings afford, and how individuals engage in them. It is this that shapes what is learnt, not that the location is labelled as a school, workplace, home, college or university. Certainly, some environments afford particular activities and interactions that make them potentially richer learning environments than others, for specific kinds of outcome. Moreover, rich or adaptable learning arises as much from experiences in practice settings as from those in educational settings (Rogoff, 1995; Rogoff and Gauvain, 1984; Rogoff and Lave, 1984). Although it is accepted that learning is a process largely premised on individuals' active construal and construction of what they experience, including their mediation of experiences afforded by the social and physical worlds, the social world makes key contributions to what is mediated. This is perhaps never truer than when the learning is of culturally and socially derived knowledge, such as is the case when people are preparing for specific occupations, and of the particular factors shaping performance requirements in specific workplace settings (Billett, 2001a).

There is nothing particularly new here. These contributions have long been identified in early psychological accounts, and in cultural and social anthropology, and were advanced in the late 1960s and 1970s through the ecological psychology and cognitive anthropology movements. Also, many early psychology accounts, including those of Janet (1930), Claparede (Piaget and Inhelder, 1973) and Baldwin (1894), emphasized the importance of influences upon human cognition from beyond the person. (That is, individuals are susceptible to social suggestion in the form of norms, practices and codes.) They saw the importance too of individuals' response to these contributions. Baldwin (1898), for instance, concluded that how individuals respond to suggestions from the social world is selective, and premised on their negotiation with that world as it is projected to them and perceived in terms of their needs and wants. Hence, the learning potentials of environments, activities and activities are not given and fixed; they are constructed by individuals.

The kinds of activity that individuals engage in, and the circumstances of their engagement, shape their learning in particular ways. Rogoff and Lave (1984) captured the contributions to cognition of purposeful everyday activities in social settings, by suggesting along similar lines that 'activity structures cognition'. By this statement they referred to the socially derived activities in which individuals engage which shape how they think, act and learn. Anthropological studies also identify some of the pedagogic qualities and curriculum practices used in situations outside of educational institutions that are generative of crucial socially and culturally generated knowledge (Coy, 1989; Hutchins, 1993; Marchand, 2008; Pelissier, 1991). The cognitive literature also provides some guidance here in terms of human cognitive processes, including the fact that legacies arise from human beings engaging in goal-directed activities (Anderson, 1993). That is – to also draw on cultural psychology – when individuals enact tasks they engage their cognitive resources and experience (Valsiner and van der Veer, 2000) to make sense of what they experience and how they need to achieve their goals.

So when individuals engage in authentic work tasks, they are learning through practice, as they construe and construct the capacities to undertake the activities and interactions arising from what they experience (Valsiner, 2000). Hence, individuals do more than just complete tasks: intra-psychological change (in other words, learning) arises. It is through this engagement in goal-directed activities and interactions in

authentic instances of work that individuals learn these capacities. However, these environments, and the activities, interventions and learning that arise from them, have both strengths and limitations.

4.2 Strengths of learning in practice settings

A programme of empirical research across a range of industry sectors (Billett, 2001b), identified four key strengths in the potential for securing occupational capacities through authentic experiences (such as learning through work):

- Engagement in work tasks;

- Indirect guidance provided by the setting;

- Practice within that setting; and

- The close guidance of other workers and experts.

Let me elaborate briefly on each of these strengths.

Firstly, workplaces provide activities and interactions which are authentic in terms of the knowledge to be learnt for work that is undertaken in those settings. Their social and physical settings offer contributions that are directly aligned with the activities to be undertaken. They can comprise genuine, not substitute or disembedded, artefacts, informed interlocutors and situational pertinent social forms, goals and activities that can likely ground cognition (Barsalou, 2008) and lead to the kinds of learning of capacities required for performance in that setting. That is, the activities and interactions have a cognitive legacy associated with the knowledge required for work.

Secondly, engagement in authentic settings and activities shapes and supports occupational learning in a range of ways. It provides access to understanding the situational requirements for performance, including the situated culture of practising in which occupational performance is grounded. Moreover, through their provision of clues and cues that assist individuals to identify both the goals for learning and the means by which activities progress and outcomes (i.e. learning) these activities and settings also support (i.e. mediate) learning. That is workplace examples, the practices of other workers provide clues and cues for proceeding. Learners also

benefit from the direct guidance of expert co-workers who can assist learning when discovery alone is insufficient (Billett, 2000; Brown and Palinscar, 1989; Rogoff, 1995). Further, the ability to observe skilled practitioners as models and opportunities to engage in joint work with them can extend the learning beyond what could be learnt through discovery. Moreover, opportunities to repeat and rehearse activities assist in procedural and conceptual development. Practice is generative of honed procedures (Anderson, 1982) and of securing conceptual associations and links (Roth and Roychoudhury, 1993).

Thirdly, there are situational factors shaping performance requirements that cannot be understood or responded to effectively without actual experience of these requirements (Billett, 2001a). The richness of these experiences also assists the process of grounding cognition and how individuals process what they experience (Barsalou, 2008). Individuals need to come to know those situational specific requirements through access to them, comprehending the requirements and monitoring how their approximations at workplace tasks realize those goals (Billett, 2001c). These aspects need to be experienced and learnt, because most likely they cannot be taught.

Fourthly, authentic activities are reported by workers of all kinds and across sectors to be highly engaging and worthy of effort. Individuals are generally keen to perform well in them (Billett, 2001a). It is through such engagements that effective (that is, well-grounded, compiled, linked) learning is most likely to arise through effortful engagement. No amount of invitational qualities or support will constitute an effective learning environment unless individuals elect to engage enthusiastically in learning related activities.

There are also a range of limitations associated with learning through work, which need to be understood and included in any informed account. These limitations need to be considered, and action taken to reduce their impact, in any efforts to improve learning in the workplace.

4.3 Limitations of learning through practice

Many of the limitations of learning through practice work against rich and adaptable learning of the kind that workers, workplaces, governments and global agencies are

seeking. From a series of studies investigating learning through work across a range of occupations and industry sectors (Billett, 2001b), these are among the limitations that were identified as being associated with both outcomes and processes of learning:

- Learning that is inappropriate (outcomes);

- Access to activities and guidance (processes);

- Understanding the goals for workplace performance (outcomes);

- Reluctance of experts to provide guidance (processes);

- Absence of expert guidance (processes);

- Developing understanding in the workplace (outcomes); and

- The reluctance of workers to participate (processes).

These limitations can be categorized into those associated with outcomes and processes and both classes are now briefly discussed.

Limitation of learning outcomes

These studies (Billett, 2001b) identified inappropriate and unhelpful work-related knowledge that was learnt through workplace experiences. Inappropriate learning included the learning of practices that are substandard or prone to cause error, including unhelpful or dangerous shortcuts that restrict the effectiveness of individuals' skills.

Of course, there are diverse views about what constitute effective work practices and appropriate or inappropriate learning. For instance, in coal mines, workers learnt the skills of negotiating effectively against supervisors to secure additional benefits. From the workers' prospective, this learning is quite appropriate. Supervisors or employers, however, did not appreciate this kind of learning and viewed it as being quite inappropriate. Some practices were identified as being potentially dangerous or 'bad' practices.

Many workers reported in these studies that they had learnt how to do work tasks but did not understand why they were doing them. This lack of understanding limited how these workers went about their work tasks and the types of goals they achieved.

For instance, again using the example of coal mining, few workers understood the process that removes foreign bodies and non-coal material after it has been mined. If workers had a better understanding of the need to remove that material, they might be more selective in their mining activities and reduce the demands and requirements for the process. Similarly, in a food processing plant, some workers were not aware of the processes that occurred further along the production process than the points at which they worked. This was partly because of the physical divides in the workplace for health and safety purposes. These factors worked against some production workers understanding fully their work goals. More fundamentally, many concepts underpinning effective work, such as hygiene, force, power, structural vectors, and the internal workings of machines and other materials that workers engage with (such as hair structure), were not observable or otherwise accessible in everyday work, and therefore were not learnt.

Whereas some forms of knowledge are readily accessible in workplaces because the activity can be observed, experienced and engaged with, this is not the case for all of the kinds of knowledge required for workplace practices. It is noteworthy here that, increasingly, the workings of technology and processes that underpin many contemporary forms of work are not easily accessible. The workings of contemporary motor vehicles, lathes and computer applications may well be hidden from view and not open to easy means of experiencing. Sometimes this learning is crucial, and this is particularly so when there is a need for workers to address new situations. Most graphically, it was found that the nuclear power plant operators at Three Mile Island were unaware of the plant's processes to the degree that when it began to malfunction they lacked the understanding and skills to respond effectively (United States Nuclear Regulatory Commission, 2004).

In these ways, although important learning outcomes can arise through practice experience, this learning also has its limitations. These include inappropriate or unhelpful learning, not understanding what needs to be achieved for effective work performance, and a lack of a requisite level of understanding about work-related activities and requirements.

Limitations in the process of learning

There are also limitations in learning progresses within practice settings. Many informants reported that workplace factors restricted their opportunities to practise or extend knowledge. That is, they reported being constrained in what tasks and interactions they were able to engage in, and from securing new learning, or interactions to develop further, refine and hone what they knew (Billett, 2001b). The combination of access to activities that are new to individuals and opportunities to practise is important for building skilful knowledge. Therefore, when workplace factors inhibit access there will be limits on what is learnt by workers.

Of course, it is not possible to provide all workers with the kinds of activities and interaction that they desire to access. The lack of opportunity might arise because of limitations in the numbers of workers who need to learn those particular activities. There can also be practical constraints associated with access to equipment that needs primarily to be devoted to production, ahead of providing for workers who might wish to learn about it. Workplaces are often highly contested environments, and opportunities to engage in particular activities and interactions might be constrained by competing workplace interests. These constraints can be a product of occupational delineation, professional or union membership, or just sour workplace relationships.

Associated with these constraints is a lack of workplace support and guidance that can assist individuals to learn new tasks and activities effectively (when they will not learn all that is necessary through discovery alone). Sometimes experts and other workers are reluctant to share their knowledge for fear of being displaced by those whom they assist. There might be an absence of experts or experienced workers available to provide guidance and support, possibly because with changing workplace requirements that expertise has not been developed. Yet, as there are perhaps an increasing range of activities that individuals will not be able to learn through discovery and experimentation alone, the role of guidance by more expert and experienced partners is likely to be central to the quality of learning for these kinds of activities and task. Hence, without access to such guidance, learning through practice may be limited and constrained.

In sum, limitations in the ability to access and secure practice within particular activities, secure guidance from more experienced workers, and engage effectively with such guidance, are likely to constrain the potential of practice settings as sites of initial and ongoing occupational learning.

Now we have outlined both potential contributions and limitations of learning through practice, it is necessary to consider how these contributions can be fully utilized and the limitations variously redressed, eliminated or minimized.

5 Informing TVET policy and practice

As has been outlined above, despite its limitations, learning through practice continues to make a significant contribution to the initial and ongoing development of occupational competence. Moreover, the urgency to more fully utilize these learning environments is increasing in line with the demand for TVET graduates to move smoothly into occupational roles, and as ongoing changes in working life demand more effective and ongoing support for occupational learning and further development. This approach to learning support is well aligned with the global goals for TVET associated with assisting students (and other learners) to make effective transitions from school to work and working life, develop their capacities for their selected occupation, and then sustain and develop further capacity across what is likely to be a long working life.

Overall, it is proposed that these kinds of experiences should be readily available and accessible to a whole range of individuals, including those who are currently working and those able to engage in workplaces for different purposes. They can often be provided without any requirement for public funding. Moreover, these experiences can be highly accessible (to anybody who is working, or who can access workplaces); they are responsive to the circumstances in which they are enacted (for example, specific workplace requirements); there is the potential for them to be widely and equitably accessed, albeit in different ways, by a wide range of learners (such as

students, novices, apprentices, experienced and older workers); and they are often directly aligned with workplace activities. These kinds of experience are often seen as effective by those who participate in them. As a result they provide attractive and potentially potent learning experiences, particularly for students in TVET institutions such as community-type colleges, schools and vocational colleges. For such students, work experiences offer the prospect of augmenting and extending their learning in the educational institutions.

Insofar as these experiences engage employers and workers in the process of learning, they extend the scope of participation and the conception of TVET provision. These learning experiences can also potentially extend throughout the working life, so their purpose goes beyond assisting young people to make an effective transition from school to adult and working life. Indeed, they can be an effective means of engaging mature or older workers in sustaining their employability across their (typically now, longer than before) working life.

Work experience is a sustainable activity, because it is part of the everyday work activities and interactions that individuals engage in and learn through when they work to produce goods and services. Finally, these kinds of experiences can be inherently sustainable insofar as they often, although not always, occur in circumstances where environmental sustainability is regulated and legislated. It follows from all of this that a more comprehensive consideration of, and engagement with, practice learning experiences might well be central to achieving the kinds of goal that are the purpose of TVET.

In summary, practice-based learning experiences offer much for TVET. They can contribute to global goals for the advancement of human learning, societal progress and cultural development, and they are particularly useful for those who are not in a position to undertake full-time study in an educational institution, or where one is not available. Learning through practice potentially offers a highly accessible, responsive, equitable, efficient, accountable, innovative, engaging lifelong provision of learning experience, which is sustainable insofar as it can often be carried out alongside the usual work done in public and private-sector workplaces.

However, all this potential needs to be realized, and this requires appropriate policy and practice. As such, learning through practice warrants serious consideration.

Discussion about it needs to be termed and framed in ways that do justice to its contributions, and make it more likely that its potential to support TVET globally will be met. As a result, it is important to shelve the term 'informal learning'. Instead, the discussion needs to focus on the contributions that learning through practice can make to the TVET project, and how it might be enacted to maximize those contributions. This paper now offers a framework for how learning might best progress through practice, which might help to achieve this outcome.

6 A comprehensive framework for understanding and promoting learning through practice

As the earlier sections of this paper have tried to show, learning through practice has made a very worthwhile contribution to TVET, although it is not always readily recognized as doing so, and it should continue to so in future. Yet, given the quality of the contribution it can make, and also the limitations discussed in Section 4.3, it is evident that if the TVET sector is to more fully realize and utilize the contributions of learning through practice, it needs a more nuanced set of understandings and practices associated with this form of learning support. In short, we need a theory or even a science of learning through practice, to guide its effective organization, enactment and the evaluation of such experiences. This theory should also assist in legitimizing this form of learning support. There are four distinct reasons for promoting such a science at this time.

Firstly, such is the complexity of and range of factors influencing and contributing to an effective provision of learning through practice, that it is necessary for these elements to be acknowledged. There is a need to provide a comprehensive account of the purposes of the learning activity, the means by which its processes are enacted,

and how various actors need to engage with them. To capture all of these elements an overall and comprehensive framing is required.

Secondly, the various elements that are likely to contribute to and form such a framework include consideration of educational purposes, curriculum provisions, pedagogic practices, the actions of those within practice settings, and also the epistemological acts of those who are positioned as learners and as guides for learning. These elements have interdependent relations with each other, and as such, need to be seen as components of a total account. Consequently, a schema is required that captures, orders and positions these interrelated elements, so that those who support and learn can proceed with some confidence.

Thirdly, educational science remains a relatively new field, and to a large extent its focus to date has been on learning in educational institutions. Therefore, a framework is required that speaks directly to the issues associated with learning through practice provisions.

Fourthly, and building on this basis, when learning takes place through practice rather than in education institutions it is probably more important that there exists a legitimating and robust framework for it. Educational institutions are held in relatively high social esteem, and are seen in ways quite different from how learning in practice settings is characterized (typically as, for instance, informal, ad hoc or non-formal). To promote the legitimacy of learning through practice, it needs to be seen as having the same worth and standing as learning that takes place in educational institutions. Indeed, to overcome the societal bias towards dedicated educational institutions in 'schooled societies' – those where schooling is the common experience - it is necessary to promote learning through practice by informing and legitimating it. It is for these reasons that a comprehensive framework of learning through practice is now warranted.

7 Framework for informing learning through practice: curriculum, pedagogy and personal epistemology

There are many considerations to be taken into account in promoting learning experiences through practice. Not the least of these are understanding how to effectively provide and integrate students' experiences in work as they initially learn the capacities required to engage in and practise their selected occupation in TVET settings, and also how the ongoing development of older workers' employability might be realized. These considerations can be seen as being organized under three broad sets of educational purpose. That is, those associated with:

- The transition from school to working life;

- Initial occupational preparation; and

- On-going development across working life.

In sum, the utility of practice-based learning can be seen as being relevant to all of the phases of learning that comprise the TVET project. These meta-purposes are now briefly set out in terms of practices which might be conducted by tertiary and vocational educators, institutions and allied agencies.

Transitions from school to working life can be enhanced by:

- Informing decisions about career selection through practice-based experiences;

- Orienting students to the world of work; and

- Enabling students to experience work in their preferred occupations.

Initial preparation of occupational competence may be enhanced through practice-based experiences by:

- The effective organization, sequencing and duration of experiences in practice settings;

- Being clear about the purposes behind any set of experiences;

- Preparing learners/students/workers to be effective agents promoting their own learning;

- The effective integration of practice-based experiences into educational programmes;

- Considerations of how most effectively to assess and certify these experiences; and

- Engaging students in pedagogic activities before, during and after experiences in practice settings to aid the integration of these experiences with those in the rest of their educational programme.

Ongoing development across working life may be enhanced by:

- Learning across working life (it is not practicable to keep sending workers back to educational settings for full-time training, and it is probably not necessary, except when they are learning a new occupation);

- Practice-based learning experiences that are fully supported, especially when what is to be learnt is novel for the learners; and

- Securing older workers' on-going engagement and participation in work and sustaining their employability.

It follows from such broad statements of purposes and the specific goals aligned with each one that a comprehensive exploratory framework for learning through practice is likely to require at least four key elements:

- The kinds of purpose that practice-based learning can be directed towards;

- A practice-based curriculum;

- Pedagogic practices; and

- The personal epistemologies of those who learn and engage as teachers or mentors, or otherwise support the learning through practice-based arrangements.

The form and character of each of these elements is now briefly elaborated.

7.1 The purposes of practice-based learning

As outlined above, there are distinct educational purposes to which practice-based learning experiences might be addressed across individuals' lives. In brief, these are associated with informing young people about work, working life and helping them to choose a preferred occupation; assisting them in securing occupational competence so they can effectively enter the workforce in their selected occupation; and continuing learning across lengthening working lives.

To commence with the first of these three broad purposes, school students complain that their decision-making about post-school destinations and preferred occupations is often uninformed, as they do not know sufficient about what particular occupations are actually like in practice (Billett and Ovens, 2007). Practice-based experiences can orientate students to their selected occupation, and inform their decision-making about and preparation for working life, while they are still at school, college or university. Students and novices might be given experiences in settings where their selected occupation is practised, to expose them to that occupation in practice. These experiences are likely to be helpful in assisting them to understand about the occupation and how it is practised, and what capacities they need to develop to practise it.

Students' own paid part-time work is one source of this learning. It can assist students to consider, critically appraise and compare experiences of work and working life. Moreover, it is perhaps most likely that the development of knowledge that is adaptable to other situations (that is, transferable occupational knowledge) will arise from an awareness of the differences between occupations, in terms of purposes, practices and required outcomes. This learning can be facilitated by students sharing their experiences with each other. That is, rather than assuming that knowledge will transfer from one situation to another, conceptions and procedures which are founded in diverse instances of practice may well provide the kinds of foundation that are most central to robust (and adaptable) learning.

Then, for novices or students to develop the kinds of rich understandings and well-honed procedures needed to move smoothly into practice and be effective in their selected occupation, they need the opportunity to engage in authentic instances of activities and interactions, through which they can deploy, extend, refine and

hone their procedural capacities, such as skills. If they are provided with sufficient opportunities, such as are afforded in apprenticeship and work placement activities, they can develop associations amongst concepts and practices that will permit effective evaluation and enactment of the particular occupation. Exposure to instances of authentic practice experiences can be used to achieve these kinds of important educational purpose associated with transitions into work and occupations. There are also purposes for ongoing learning throughout working life associated with sustaining employability through engagement in practice-based experiences. These include how these experiences might assist individuals to change occupations, develop specialisms, and continue to confront the changing requirements of occupations and workplaces.

These purposes are quite distinct, and each one requires particular kinds of experience if it is to be realized. The kinds and duration of experiences required to understand an occupational practice, or versions of it, are quite different from those needed to develop the conceptual and procedural capacities required for effective practice in that occupation. Purposes associated with maintaining employability across a long working life also require different kinds of experience and support. Consequently, a framework for learning through practice needs to account for how these different kinds of purpose might be realized through the enactment of particular kinds of experiences in practice settings. This then leads to consideration of a practice-based curriculum.

7.2 A practice-based curriculum

Here the focus is on curriculum as the framework for the organization of the experiences that learners participate in and learn through. Such a conception is analogous to the original meaning of the word curriculum: in Latin it refers to 'a path to follow', 'the track to run' or 'the course of life'. This conception is well aligned to learning through practice, as anthropological studies have identified that this is the way learning experiences were organized long before the advent of educational settings, as well as its having continued as a major form of learning thereafter.

To put this differently, there is a sequence of activities that individuals (such as novices) need to engage with and progress along, which are supportive of learning

processes and outcomes. In her classical study of tailoring apprentices, Lave (1990) described the curriculum she identified as a pathway of work activities in which the apprentices progressively engaged and along which they progressed. Most of their learning occurred through engaging in and learning a sequence of tailoring activities, largely without the direct guidance of more expert partners. Moreover, given the importance of the learners' agency in this approach, considerations of personal epistemologies seem to sit well with considerations of augmenting a practice-based curriculum and pedagogy.

Firstly, the apprentices engaged in activities that allowed them to recognize the components of the garments they would come to make, and the quality of work undertaken by more expert tailors. This established some of the key goals for learning associated with tailoring work. The learning arose through a process of observation and initially working on those garments (for instance, performing finishing tasks). Then, the apprentices were able to engage in the construction of quite simple garments (that is, children's underwear) where mistakes could be tolerated because there would be no great consequences. Next, apprentices progressed through manufacturing other kinds of garment such as adults' underwear, before going on to make garments with greater skill requirements such as shirts, then jackets, and ultimately ceremonial dress.

The organizational principle was movement from activities in which errors could be tolerated, through to those where mistakes came at a high price (for instance, because they might ruin a large and expensive piece of material). The sequencing of these activities was structured to progressively engage novices in increasingly demanding activities, each requiring incrementally greater levels of skill. Similar pathways have been identified in studies of hairdressers (Billett, 2003), in food production (Billett, 2011), building (Marchand, 2008) and porcelain making (Singleton, 1989).

Consequently, it is probably helpful to consider a practice-based curriculum in terms of the sequencing of workplace activities (the jobs, tasks and interactions) to provide a pathway for novices to first understand the requirements for the work and workplace, then progressively have the opportunity to develop the kinds of capacities required to fulfil those requirements. This may well include apprentices coming to realize that it is their responsibility to initiate and direct their learning. Therefore, developing

the learning curriculum requires an identification of the sequence of activities that novices need to engage in to progress towards full and effective participation (Billett, 2011). Moreover, there is also a need to identify the kinds of knowledge that are not likely to be learnt through individuals' personal process of discovery along this pathway of activities. These kinds of knowledge will require particular pedagogic interventions to secure their initial learning and appropriate level of development.

7.3 Pedagogic practices

Pedagogic practices can be seen as those that enrich individuals' learning in ways which participation in social practices alone is not able to achieve. There are two kinds of pedagogic practice that are most central for learning effectively in practice settings. The first is direct guidance by experts, who can use particular strategies to support the learning of particular kinds of knowledge. Secondly, there are workplace activities that are inherently pedagogically rich.

Rogoff (1995), in presenting the concept of guided participation as a pedagogical practice, provides examples of accounts that acknowledge how the potential of learning through authentic settings and activities can be enriched through interaction with a more experienced worker. In guided participation, a more experienced co-worker assists the development of the novice through interpersonal engagement, including joint problem-solving activities and direct guidance and instruction (for instance modelling, coaching and scaffolding). Beyond engaging in direct activities with novices that permit opportunities for observing and learning about how more experienced workers think and act, this concept extends to using particular instructional strategies. Specific instructional strategies can be helpful in developing particular kinds of 'hard to learn' workplace knowledge. For instance, modelling, coaching and scaffolding can assist the development of procedural capacities (in other words, learning how to perform tasks effectively). This assistance includes providing opportunities for novices to practise, refine and hone those procedures.

Strategies such as questioning, explanation, and visual representations of different kinds can be used to promote learners' conceptual development (conveying factual knowledge, propositions, associations and causal factors). There are also strategies

such as observing and listening to effective practitioners that can be helpful in assisting the development of dispositions (attitudes and values) associated with a particular occupation and circumstance of practice. All these kinds of pedagogic practice can be used by more experienced practitioners or workers as part of everyday work activity to assist the learning of those who are less expert or experienced.

Second, some work activities are inherently pedagogically rich, and provide particularly useful opportunities for individuals to learn. An example is the handovers that occur between nursing shifts in hospitals. The nurses on the outgoing shift normally brief those on the incoming shift about the patients they will need to nurse, their conditions, their current treatment, how they are responding to the treatment, and the prognosis for their future. This activity involves description, identifying connections and causal associations, assessing progress and making predictions about how the interrelated factors might impact the outcomes and interventions. Those involved need to consider their conceptions of patients, treatments, selection between the options for treatments and conditions, appraising the various options and possibilities, and making judgements about which approach is most likely to be effective. Importantly, in practice settings learners at different levels of development can gain from involvement in this kind of activity. Novices can begin to understand something of the language and discourse, and identify terms and concepts as they are being used. More advanced learners can begin to make associations between the characteristics of patients, their treatment and their response to it, preparing them for making assessments and decisions in the future. Still more advanced learners can develop a deeper understanding of the causal factors that play out together, and in time come to engage in conversations with other practitioners about the progress of the patients, and prognoses for their future.

As this example shows, pedagogic practices that are either enacted by more experienced practitioners or shown through workplace activities have the potential to enhance and enrich the learner's experience in practice settings. Together, these pedagogic practices stand to support the effectiveness of practice settings as learning environments and enrich the learning of those who participate in them.

7.4 Personal epistemologies

Personal epistemologies comprise the ways that individuals engage in activities and interactions, construe, construct and learn from those experiences (Billett, 2009; Brownlee and Berthelsen, 2006; Smith, 2005). Such epistemologies have dimensions of personal intention, intensity of engagement, and existing capacities that shape individuals' participation in activities and interactions and their learning from them. As noted above, the utility of learning through practice depends to a large extent on the degree to which the students actively engage in the process of learning through practice-based activities and interactions. How they engage with what they are offered in terms of a pathway of experiences and pedagogical practices depends on each individual's personal epistemology.

This has an impact on key aspects of the learning process such as how individuals elect to engage in everyday activities, observing and listening, engaging in practice, and interacting with more experienced co-workers. Hence, personal epistemologies stand as key bases for learning through practice, not least because in settings where individuals are not constantly being guided and coached by a teacher, it is up to them as individuals to construe and construct the knowledge required for the work.

Another important aspect of this issue is the personal epistemologies of those who assist and support the learning: teachers, guides and mentors. Their values and actions are central to the kinds of assistance and support they afford learners.

Now we have outlined the practice-related issues that are required to support learning through practice, it is necessary to identify how these might inform TVET policy.

8 Policy issues related to learning through practice

The policy considerations here extend to making workplaces effective learning environments through the organization and sequencing of experiences, and determining how to enrich these experiences through specific pedagogic practices and pedagogically rich workplace activities. It is also necessary to consider the kinds, duration and sequencing of practice-based experiences in educational courses, and the experiences provided in educational institutions prior to, during and after students' workplace experience.

The TVET policy must also cover older workers who need to be retrained to ensure their continuing employability. As was noted above, the needs of these learners are often particularly suited to practice settings (Dymock et al., 2009). However, these workers may well resist being invited to engage in training programs because they believe themselves to be already competent, do not want to be seen as students, and indeed often see it as more appropriate for them to contribute to others' learning in a guidance capacity.

It is unlikely that this approach to assisting learning will be fully effective unless practice-based learning is legitimized and understood more fully, its potential contributions are elaborated in greater detail, and the means by which it is put into practice are more solidly informed. Some of the key policy focuses for realizing its potential are:

- Supporting and legitimating the standing of learning through practice (in other words, overcoming the negative connotations from the schooling discourse);

- Supporting the development of approaches that give access to and enrich learning through work (work practices, workplace curriculum and pedagogies);

- Supporting approaches to assessment for practice-based learning and its certification, ensuring that it is seen as equal in standing to learning in educational institutions;

- Supporting young people's access to occupational practice so that they can make informed choices about their careers; and

- Preparing TVET educators, and helping them acquire the capacities to understand and support learning through work.

These aspects are now considered in a little more detail.

8.1 Supporting and legitimating the standing of learning through practice

As we have seen, learning through practice is extremely important for achieving governmental, societal, workplace and personal goals, but it is often undervalued by the wider society, and seen as an informal activity that lacks the legitimacy of learning in school or college. There is a need to change this societal sentiment. Governments, workplaces and individuals are far more likely to take learning experiences seriously and choose to invest in them if they are seen as being worthwhile, legitimate and potent, rather than weak and unimportant.

The key policy focus here is to champion these kinds of important settings for learning across working lives. Support needs to come from government bodies, professional associations and educational systems. Possible approaches include public education about the benefits of learning through practice, and advance frameworks and mechanisms that will support that learning and also enhance the way it is assessed and certified. Other policy levers might include funding support or tax concessions for enterprises that invest in supporting employee development within the workplace.

It is unlikely that a single initiative will be sufficient to change the perception of workplace learning. A number of activities will need to be pursued in combination, including initiatives aimed at changing society's view, providing mechanisms to enable and recognize workplace learning, and incentives for employers. Professional and other occupational associations (such as trade unions) will need to play a role in supporting and championing practice-based experience, and publicizing the role it can play in both initial learning and ongoing professional development. For example, they might specify that a certain amount or type of practice-based experience is necessary prior to professional qualification.

Educational bodies also have an important role to play. This is likely to require new ways of thinking and acting from educators, because much existing practice is closely associated with classroom-based provision, or distance learning (online or text-based) along many of the same lines.

8.2 Supporting the development of approaches that give access to and enrich learning through work

Following from this, there is likely to be a need to develop a range of approaches to supporting learning in practice settings, and to appraising its worth. Often the learning activity can be integrated with everyday work: there is no reason to try to duplicate the methods of classroom-type learning in the workplace setting. In particular, there is a need to develop an understanding of how practice-based learning experiences should be sequenced. This applies both to initial learning about an occupation, and to ongoing development of employees.

These are the curriculum considerations. Pedagogically, there is a need to identify a range of strategies that can be used to augment learning in the workplace and address particular workplace requirements. For instance, as was noted earlier, often some aspects of work-related knowledge are not readily accessible. A process might be hard to see and access because it is abstract, remote or hidden, as is often the case where advanced technology is used. In these cases it is necessary to find ways of making visible to the learners the production or electronic flow processes.

Specific pedagogic strategies might also be needed to help students learn about intricate procedures, ones that are particularly demanding, and ones when there might be some danger to learners if they do not undertake a task correctly. The aim here is to assist workers to learn to use particular kinds of tools or technologies in ways which develop their competence without any risk of harm to the individual, other people or the production process.

There is also a need to address the development of understanding. This often comes from explicit interventions. In other words, the learner needs specifically to be invited to think about the consequences of a particular action, or perhaps to consider other contexts in which they might apply a technique they have learnt. The

suggestion here is not for formal instruction on the classroom-type model. Normal workplace occasions can be used for this purpose: perhaps a discussion over lunch, or during a production meeting, times when workers naturally share information and understanding. Time-honoured strategies such as modelling, demonstrating, coaching and fading, that are the withdrawal of support, also have place in assisting realising this learning.

In all of this activity, there is a need to consider how particular groups of learners can best be supported. For instance, older workers who are less familiar with electronic technology may need a different kind of support from younger workers who use computers and related technology more easily. In contrast, younger learners who do not have substantive workplace experience might need greater support in developing some types of competence than do workers who have extensive experience.

8.3 Support approaches to assessment and certification for practice-based learning

There is also a need to develop approaches and mechanisms for assessing and certifying practice-based learning. In the workplace itself, there is typically a kind of continual assessment of learners: those guiding them will naturally make judgements about the quality of work done and the capacities of those doing it. These processes now need to be extended through mechanisms that can lead to formal certification of the knowledge acquired.

Again, it would be a mistake to use the models developed for use in educational institutions. Assessment processes need to meet standards of validity and reliability, but this must be achieved in a way that acknowledges the specific characteristics of the learning process. So the aim is to develop methods and approaches to assess competence in ways that are fair and valid, and to certify that the learner has acquired the knowledge and skills in a way that carries the same standing as do qualifications from educational institutions. Many countries, particularly those with advanced industrial economies, have now developed national qualification schemes and systems that are not restricted to the types of learning acquired in educational institutions. This is not a difficult requirement to fulfil, but it does call for support

from government, endorsement from professional and occupational associations, and effort to make the assessment and certification an integrated part of the vocational educational system.

8.4 Supporting young people to make informed choices about their preferred careers

As noted earlier, it is important that young people make career choices that are appropriate for them, and they can do so more readily if they have some experience of workplaces and the activities that take place in them. In many countries there is a high – and sometimes a growing – dropout rate during the process of qualifying for a job or profession. This carries a significant cost: to the individual, to the potential employer that has invested in their training, and to society as a whole. Activities that succeed in reducing the attrition rate may well prove to be cost-effective. Consequently, it is desirable for governments, professional and occupational bodies, and employers to work together to find ways of giving young people (and older workers who are changing career) a good sense of what a job will be like in practice.

8.5 Helping TVET educators to acquire the capacity to understand and support practice-based learning

Much of the conventional theory about vocational education derives from classroom-based educational provision, and this is the type of TVET with which many educators are most familiar. When they have developed competences and built their career in this environment, it can be a challenge to engage them in supporting workplace-based and practice-oriented learning.

Therefore, existing vocational educators are likely to need professional development to familiarize them with the demands of this rather different type of learning, and similarly, it needs to be included in the training of new generations of vocational educators. Both groups need to be guided to appreciate how learning through practice differs from teaching in an educational institution. They need to understand how a curriculum can be developed for practice-based learning, and what pedagogical practices are likely to be appropriate in this context. Related issues

include assessment and certification of practice-based learning, and the means and mechanisms to capture knowledge learnt in these settings.

In many – perhaps most – countries, many vocational educators come from an industrial background, and have a good understanding of the broader working environment. Often they are aware of, and sympathetic to, the learning potential of experiences in practice settings. As with the policy suggestions above, a concerted effort involving government bodies, professional or occupational agencies, and educational bodies is likely to prove best at supporting this particular initiative.

Taken together, the suggestions made here comprise a nested set of the policy imperatives that are likely to be needed to assist with the broad take-up of supporting, legitimating and recognizing learning in the circumstances of practice.

9 Learning through practice: In prospect

In summary and conclusion, it has been proposed here that practice-based learning experiences are central to the TVET project. However, to maximize their potential across all phases of this project (that is: identifying an occupation, preparation to take up that occupation, and ongoing development across working life) there need to be a set of policies that promote workplace learning and help to bring about a change in the current perceptions of it.

Such policies should promote an understanding of the worth of practice-based learning, of how these experiences can be fully utilized, how they can be enriched through appropriate pedagogic interventions and practices, and how to ensure they are engaged with effectively by workers, students or learners.

The overall goal of promoting the TVET project needs to be achieved through the kinds of policy and practice objectives set out above. Each of these objectives needs to be advanced on an informed basis by practitioners who understand the potentials and limitations of learning through practice, and how it can best be used to meet the objectives of TVET.

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