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WORKING PAPER

Education and Work — what can and what can't be learnt from and at work, and why?

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Introduction

This section of the project (henceforth 'the brief') is written from the perspective of the EWSETA being a provider or accreditor of short courses as part of the broader effort in South Africa to improve the provision of professional education in preparation for work as well for development during employment. Whilst there is a consensus that education in necessary for preparation and for development of occupational workers (henceforth 'workers') there is debate on what form of training is more meaningful, educationally, and more productive in terms of improvement of work.

The brief is divided into two parts:

Part I covers three issues: a short introduction on the main differences between the education and work sectors in terms of the production and use of knowledge. This is followed with a short discussion on the intention behind qualifications (be them a diploma or certificate or a whole qualification). The general idea is that qualifications function as an institutional means to create an interface between education and work by structuring the supply of labour in line with market demands. More specifically qualifications are intended to convey to employers, in somewhat transparent ways, the relevance of the qualification to their work needs. We end this part of the brief with a discussion on apprenticeships, which in some parts of Europe (Germany for example) and to some extent in West Africa, were shown to offer quality form of preparation for work. Their import lies in developing a dual system whereby learning from work is tied up with learning from formal instruction. Their contribution in South Africa is noted.

Part II presents five perspectives on the question of preparation for and development during employment. We begin with the view which promotes the provision of courses on generic skills. We note the limitation of this idea in general but specifically when thinking about training as strengthening one's occupational specialisation. The second view is associated with what is commonly known as "learning in and from practice" and is focused on work experience or being involved in practice and reflecting on it together with "old timers". The key concept discussed by the proponents of this view is "learning by doing". The third view is in agreement with some of the ideas proposed by the practice theorists, but is focused on addressing the main weaknesses noted by its critiques - poor explanation of generalisation. To address this critique, we draw on the social practice perspective offered by David Guile. Whether or not 'generalisation', which is very important for professional judgement, is well addressed by Guile's work remains in question. We then turn to the fourth view which we refer to as 'the knowledge view' because of its emphasis on the importance of formal instruction of bodies of knowledge before their application in practice (whether in preparation for work or for development during employment). There are some commonalities between views 3 & 4—specifically the idea that experience is always mediated by concepts (and hence generalisable to some extent), but there are key differences between them which have implications for thinking about curriculum design, and about structuring of work-based learning. The knowledge view offers much more substance on what constitutes professional knowledge and on ways in which practice has to be structured if it is to become practice for learning. In terms of learning, the learning *from* practice (views 2&3) position is an inductive view of learning and the application of knowledge and practice to specific instances position is a deductive view of learning. The fifth position, 'the eco system approach' introduces the importance of systematic collaboration and partnerships as a necessary condition for the organisation of the different stakeholders involved in the process of preparation and development of workers.

Part III offers a few notes on curriculum design pointing out the limitations of competence-based curriculum and the value of bodies of knowledge for preparation for work. We then present advantages of deductive learning to show that work based learning is constrained if it is not well planned and well-structured, and if the novice worker is not supervised by a trained expert that can anticipate occurrences in advance and is well posed to guide the novice to link instances with theories.

Our conclusion offers 10 claims we propose to take out of the brief.

NOTE: we use the term 'novice worker' to refer to a person who is studying to become an occupational worker (at different levels of employment) or is undergoing training during employment for reasons of professional development.

Part I

Education and work are two very different social spheres.

Education and work are organised differently. Knowledge is used in both but in very different modes. Knowledge produced in the sphere of education is radically different from the specific and discrete forms of everyday working knowledge. And yet, many education programmes, both within higher education and vocational education programmes have the expressed purpose of preparing people for work, as if education and work can be juxtaposed unproblematically. Often the blame is placed on education institutions for being inflexible and not producing programmes of learning relevant for the workplace and universities and TVET institutions are pushed to be more demand-driven. The link between education and work is stronger for the regulated occupation and traditional trades (Wheelahan & Moodie, 2018, p. 135).

What is the difference between the two spheres?

Knowledge is produced and transmitted in the sphere of education, by taking huge steps away from what is common and familiar—we call this distanciation, because it involves creating a distance from our everyday experiences, and delving into bodies of specialised knowledge which have been produced over time (sometime centuries) by scholars of different discipline specialisation. One key aspect of discipline specialisation is that concepts are connected to other concepts in discipline-specific ways, and form part of a greater and vertically structured body of knowledge. They are referred to as bodies of knowledge because they are structured by boundaries which rule what belongs within and what belongs outside a specialisation as well as what parts of the discipline comes before others. These bodies of knowledge help us research for more certainty, and help us have more coherent analysis of the object we are investigating. But, bodies of knowledge do not always speak directly to the problems we face in our day to day working lives. The sphere of work has systems and procedures as well as structure and order. But the logic of order is not about relation between ideas and concepts as they developed over time but rather about what will promote an efficient use of systems, machines and tools. Similar systems are clustered together, each embodies knowledge of experts, at times knowledge is

drawn from a variety of disciplines. The sphere of work is also characterised by uncertainty of the end result and by fast pace. Many solutions to problems are standardised, many are not. The former sets of solutions consist of long and complicated standardised procedures, the latter require judgement, care and dextxerity (Gamble, 2018). Often decisions are made in complex operational conditions such as insufficient appropriate material resources and lack of time, needing to maintain good labour whilst competing against market forces etc. Mistaken judgements are costly and may sever relations with clients. There is a further challenge at the sphere of work—it is changing fast because of technology, and space is no longer a local construct; it is becoming more and more global. How work is organised, its intensity and pace, and its effectiveness are subject to local, and global forces.

The drive for solutions exerts pressure on educational institutions to identify knowledge which fits for purpose, and procedures which reduce risk and help construct standardised operations. At times the two processes (knowledge production and fining solutions) dovetail but in general they are not. This is largely because of reasons to do with the methodology of knowledge production which requires time for testing and evaluation. In addition, some work situations are similar, but many are not and so knowledge appropriation is a long inferential process. Given the pace of work, its organisation, and the variety of pressures affecting work, there isn't often, however, the luxury of time to select 'exactly that specific part' of what we know and fit it into solving a specific problem. In the end, it is worker's accurate and appropriate judgement which will have lasting positive effects, and the question then becomes **what prepares workers for professional judgement.**

Qualifications as the labour market interface between education and work

Qualifications are generally seen to be a symbolic expression of sustained study for a designated period in a designated area. Qualifications are intended to stamp the ability of an individual to do something, which in turn, determines their place in a division of labour in the labour force, and their earnings. Because qualifications are used when persons move between education and the workplace, they are seen as a mechanism for translating something obtained in one area (e.g., TVET college) to something desired in another area (factory). They have come to be seen as an indicator of the skills workers have acquired through education which make them more productive, and of higher economic value in the labour market.

The literature on qualification points out the following problems:

- In some occupations, particularly in highly regulated occupations, instead of being used as indicators of productive skills in the labour markets, reports show that qualifications function as vehicles for social closure. Here qualifications function as a mechanism for legitimating inclusion and exclusion. They create labour market shelters for those who possess them (Freidson, 2001).
- Employers in unregulated occupations (clerical, management consultant, financial analyst, construction project manager etc.) use qualifications as a proxy for general ability to learn and of social attributes (such as the status of the provider) rather than as indicators of knowledge of the specific work the candidate applies for.
- Ronald Dore (1976) coined the phrase "diploma disease", to suggest a distorting effect on education systems. It is also referred as "credentialism" by Randall Collins (1979). The idea is that the social and economic value of qualifications diminishes while the level of knowledge in the programmes they represent remains the same. This, Dore argues, leads to a vicious circle of more and more people trying to obtain qualifications, which in turn further lowers the value of qualification. Qualification inflation or credentialism is a major contributor to what is perceived as education/labour market 'mismatches', when the actual content of learning programmes is seen as having an ever-diminishing relationship with the work needed for specific jobs.
- Allais (2020) reports from the African Union studies that in the last 7-8 years attempts have been made in Southern, West and East Africa, respectively, to create a regional framework for higher education qualifications (in addition to national qualification framework which already exists in most of the countries). No research is yet available on the efficacy of these regional systems. There is, however, a lot of research on the limitations of national qualification framework to reduce the growing youth unemployment or to increase the match between supply and demand. The strongest reason for this is the absence of structural economic change (p.3), an important finding which is beyond the scope of this project. Stephanie Allais notes:

  > The AU study argues that there are many weaknesses of regional bodies, and that it is not clear whether they have the capacity to develop and implement regional qualifications; certainly, progress has been slow to date, according to the report (African Union, 2020). Nonetheless, the report argues for the necessity of an African Continental Qualifications Framework by 2022, with the aim of contributing to enhanced comparability, quality and transparency of qualifications of all levels and from all sub-systems and facilitating recognition credentials and therefore mobility of learners and workers. *What is striking is*

> *the little evidence provided either that qualifications are currently a primary barrier to mobility, or that qualifications frameworks have improved mobility.* Clearly, further research in this area is needed. (p7, my addition)

Work based learning in the form of apprenticeships

Formal apprenticeship is an institutional resource developed to improve workers' transition from education to work, to access work, and to strengthen professional formation more generally. Other forms of work-based training include on-the-job training, self-training, learnerships; short courses, training workshops, mentorships, and informal apprenticeships. In this section of the brief, we only review (and in short) some literature on the provision of apprenticeships, first in the UK and Germany and then in SA.

Founded in 19th century, apprenticeships in the United Kingdom are about learning in the workplace and are a response to the idea of worker's right to receive instruction (Clarke & Winch, 2004). During their early period, apprenticeships were protected by the strong collectively bargained apprenticeships led by labour unions (Streeck, 2012). Today, however, the apprenticeship system is largely dependent on employer willingness to participate, a situation similar to South Africa. A contract is drawn up by the learning and skills council and is signed by the employer, trainee and the body responsible for training.

The system of apprenticeships in Germany stands in contrast to the United Kingdom and South Africa. Apprenticeship is widely accessible and publicly supervised. For a long period of time starting from the mid-19th century, the German vocational training system has been jointly regulated at an industry level. Trade unions, employer associations and the state jointly administer vocational training with an emphasis on a strong occupational identity which governs both licencing and mobility. This system referred to as "the dual system" and needs to be noted for the employer engagement in both the design and provision of training. The worker's practice is monitored "in operational conditions together with instruction and reflection in an academic environment, which provide both the conceptual and theoretical underpinning of the relevant occupation and the opportunity for deepening conceptual understanding in practical conditions"(Winch, 2016, p. 46). Trainers are required to have a university education or occupation qualification, they must provide proof of didactic skills, often through a specific national trainer test. Some more worthwhile noting include:

- The apprentice is typically a junior employee

- Time is divided between learning and working in the workplace.
- Formal learning includes theoretical, technical, civic and liberal instruction and typically covered over a period of three years (1 or more day a week) (Winch, 2016, pp. 46–47)

According to Allais (2020, p. 9), although South Africa "is the country with the most extensive formal apprenticeship system on the continent", it graduates "fewer than 30 000 apprentices a year". With the exception of West Africa, most of the apprenticeships in Africa are informal and are tied to the dominance of informal employment. These are offered mainly to young poor learners with low educational attainment. They do not contain any formal instruction and their length, cost and quality vary a great deal. Also interesting to note, is that by comparison to the rest of the world, firms in Saharan Africa offer less training, and mainly by large firms only.

> Ngatia and Rigolini (2019) suggest that about 30 percent of formal sector firms in Sub-Saharan Africa provide training, compared with 35 percent in the rest of the world, with percentages varying from 9 percent in Sudan to 55 percent in Rwanda. In all regions, firms more likely to provide training are large firms, or firms that export. In sub-Saharan Africa 23 percent of smaller firms provide training, compared with 41 percent of medium firms and 52 percent of large firms. Similarly, 29 percent of companies that don't export provide training, compared to 41 percent of exporting firms.

Moving to the history of apprenticeships in South Africa, it is important to note that their history is linked to the arrival of the European settlers, the racial and social structure of exploitation which they developed, and even more specifically, to slavery (Wedekind, 2018, p. 106). Right from the start, "apprenticeship in South Africa was a coercive and exploitative relationship rather than a benign relationship between a master craftsman and a novice" (2018, p. 107). Alongside the mineral revolution when the formal technical and vocational system was established, the apprenticeships system (in part shaped by the 1922 Apprenticeship Act) became more regulated. Laws such as job reservation and minimum school level attainment excluded it from the majority of the black population. Only in 1981, with the introduction of the Manpower Act, skill development system (which included apprenticeship) was put under a new employer-directed system at a national level, and access to skills training programmes and apprenticeships opened to the black population (2018, p. 110). The prominence of the apprenticeships system started its decline in the mid-1980s with a substantial decrease of apprenticeships in state-owned companies where most apprenticeships were based. Some of the factors influenced this trend in later decades include the shift in focus of the vocational system, decentralisation and

privatisation agenda of the state, shift into financial services and severe decrease of industrialisation, and no industrial policy to guide any prospective change (Allais & Nathan, 2014).

Since the early 2000, work based training in South Africa is delivered through "learnerships" which are open to all occupations and not just to artisans. Learnerships are fixed-term employment contracts with a company while studying for a qualification registered on the NQF. Learnership are administered and funded by SETAs and are designed as a modular system to allow several companies to be involved in the training. The programme comprises a theoretical and on-the-job training and can usually be completed within 12-18 months. They rely on the goodwill of companies to provide a structured programme.

Part II

Perspectives on Professional Education

View 1: Generic skills

There is a growing popularity to the argument that given the fast changes in the nature of work, specialisation as a mode of preparation for work will narrow the scope of employment. Occupations will disappear and so new adepts need problem solving skills, flexible skills, practical knowledge and not specialised bodies of knowledge. Notions such as creativity risk taking, problem solving, critical skills and communication have been foregrounded. Here is the anomaly involved with the idea of teaching generic skills: Skills are linked to specific tasks, which in turn are specialised to an occupation (or to more than one occupation) and are underpinned by a tradition of bodies of general knowledge, practices and procedures, from which specific knowledge, practices and procedures were selected for learning an occupation. This means that behind what appears as a generic skill are layers of different types of knowledge which have developed first as pure or applied disciplines and then as specific specialised knowledge. This is why to teach critical skills in Law would be very different than teaching critical skills in Environmental Science. Both from a learning or teaching perceptive the call for generic skills for employability is not making sense. In this brief we follow the idea of knowledge-based occupation (See more in Shalem & Allais, 2018a).

View 2: The practice turn - Reflection in and on action

The most common view of professional education is that professional knowledge develops through experience, through doing activities. Many educational reformers argue on pragmatic

grounds that by strengthening the relationship between education and the everyday world of work, education is better placed to prepare learners for a fast-changing social and economic life (Murgatroyd, 2010; Sahlberg, 2006); In the field of vocational education there a growing pressure to increase the amount of time spent in the workplace and to focus novice workers' learning on authentic work tasks. A common rationale behind these calls is the idea that it is by actually being in the workplace—in the presence of "old timers"—planning, doing and fixing, by iteratively being involved in aspects of practice, that novice workers acquire practical knowledge or the know-how of professional knowledge. One of the main proponents of that view is Doland Schön (1983, 2001) who argues that using experience from previous situations to reflect on new situations is key for learning professional knowledge. He argues that this kind of learning has much more effect than the technical rationality which governs formal instruction, which assumes smooth transfer of professional knowledge from formal learning to actions in work settings. The problem with formal learning is, so the argument goes, is that the orderly and structured mannered way in which knowledge is transmitted cannot be translated to the ways in which workplaces work. The idea of the gap between education and work and the specific interest with tacit knowledge gave rise to what is commonly known as 'the practice turn' (Jensen et al., 2012; Knorr et al., 2005). This body of literature is associated with the famous contributions of Gilbert Ryle (1949) and Hubert Dreyfus (Dreyfus & Dreyfus, 2005) and it addresses the following issue about workplace knowledge - that much of professional knowledge consists of modes of operations that cannot be made explicit by discursive means (Selinger et al., 2007). Tacit knowledge is the intuitive aspects of professional knowledge, which cannot be codified; it embodied in practices and workplace activities and is learned through doing.

> You may have mastered the way surgeons talk to each other but you don't understand surgery unless you can tell thousands of different cuts from each other and judge which is appropriate. In the domain of surgery no matter how well we can pass the word along we are just dumb. (2007, p. 737)

The practice turn view calls on two foundational claims about tacit knowledge: Ryle's (1949)—that no amount of accumulative knowledge (formal knowledge or "knowledge that") will prepare one for practice (practical knowledge or "knowledge how") and Michael Polanyi's (1966)—that "we can know much more than we can tell". The argument held by this view is that practical knowledge and its tacit aspects, in particular, can only be mastered through practical experience, by being directly involved with objects, products and services in the workplace (Nonaka and Takeuchi in Guile, 2010, p. p.34; See also Sellman, 2012). On this view there is a gap between

education and work which mirrors the gap between explicit and tacit knowledge (Shalem & Slonimsky, 2013).

This take on professional knowledge is that action precedes knowledge—practicing a thousand possible permutations of surgical cuts and doing experiments with an expert is necessary for gaining discernment of the idea (of surgery), for accessing criteria of practice. By having to face different workplace organisations and cope with novel situations, in particular those that are marked by "uncertainty and indeterminacy" (Schön, 2001) novice workers get access to the 'real stuff' to 'the tacit form of personal knowledge' (Eraut, 2000, p. 114). By spending enough time with an old timer, criteria of good practice get transmitted, and tacitly acquired, through the process of "indwelling" (Polanyi, 1966 in Guile, 2010, p. 49). A key words on this view is "participation" in social practice and "learning by doing" (Guile, 2010, 2014; Lave & Wenger, 1991). By means of action research, personal observations, field work and continuous experience in the site of practice, novices cultivate practical wisdom, they become proficient and then expert. On this view proficiency is associated with fluency or the idea that the worker is no longer rule bound, can move smoothly from one problem to another without being caught by the rigidity of rules and procedures. Knowledge is automaticity, it is embodied and it is exercised. Practice-based theorists promote the idea that "first-hand encounter with the actors in their own settings, in the midst of doing whatever it is that they do every day, with whatever is required to do it" (Miettinen et al., 2009, p. 1315) is the best way to capture 'the seen-but-unnoticed' (2009, p. 1316).

The growing popularity of the practice turn and Schön's idea of reflection in action more specifically, can be explained. Only some professions (e.g., engineering, medical profession and other hard science-based professions) have what Andrew Abbott calls relatively tight links between academic and diagnostic classifications. These professions have developed law-like procedures that they can follow (more or less strictly) when they address and solve problems. But many professions which are based on soft sciences (on humanities and social sciences e.g., teaching, social workers, lawyers etc) do not have this clear reservoir of cases. The idea of learning from practice, the idea that as you go you understand more because you see what works and you learn from your mistakes, is attractive to those professions.

Notwithstanding, reflection in and on action became the thing in itself, the sought-after form of training across the board, across all professions. The main shortcoming of the over emphasis on

experience and practice is that we are not given a way to distinguish between professional (expert's judgement) and everyday judgement (ordinary lay person judgment). The notion of reflection does not help to understand what constrains professional judgement, what makes them right, better and specialised, and what makes them different in quality from ongoing everyday judgement made by lay people. This view, which critiques the idea of transfer or the application of knowledge from bodies of generalizable knowledge to particular situations, does not explain how valid generalisations are formed, and yet generalisations are central to many of the decisions made by professional workers. Barnett (2006, p. 145) puts it strongly when he says that situated knowledge "is often trapped within its context of application'. One can learn a set of instructions off by heart, but this will not even approximate to the 'know-how' that is crucial for adequate performance".

It is further argued that the overemphasis on tacit knowledge, intuitive judgement, fluency and embodiment have contributed to the growing of *anti-intellectualism* in the approach to professional education and/or professional development. In Winch's words (2010, p. 123), the educational project of "instruction, explanation, training and exemplification" is made secondary or in a worst case scenario, redundant. There is an increasing tendency to downplay the importance of bodies of formal knowledge acquired in formal setting. This is a crucial omission in the field of professional education for two reasons. The first is that professional knowledge draws on several bodies of knowledge. It draws on more than one subject matter (professional knowledge is interdisciplinary), and in addition it must include legal, civic and ethics of knowledge. The second is that any activity a worker engages with involves certain standards. Those standards have been developed in the profession over many years. Professions adhere to a tradition and the standards developed are enacted in the routines and procedures, but most of them need to be formally taught.

The emphases on the exercise of professional action, and on professional knowledge being predominantly tacit and experiential do not explain how professional knowledge is transmitted in experience. As Winch (2010) argues, these emphases leave significant gaps in understanding the connections between systematically organised knowledge, action, ability and evaluation. Without that, without the question of transfer one does not know what models of training, including work-based learning, are more productive than others, what kinds of mentoring by an old timer are more effective and how they should be structured. In the last instance, the aim of a work-

based experience is to equip one with practical knowledge that is valid and reliable beyond the context of acquisition.

In the next section we turn to David Guile, a British professor of education who offers the notions of *inferring* and *mediation* instead of reflection to explain how one learn concepts (which are central to the ability to generalise). Guile continues with the idea of situated participation within a community of practice and is drawing on activity theorists such as Y Engeström. But he also turns to Lev S Vygotsky to theorise the formation of concepts or conceptual knowledge-knowledge that can be generalised.

View 3: The social practice perspective

David Guile was influenced by Lave's critique of the idea of transfer (that professionals do not learn to practice by learning ordered propositional knowledge) but he was attentive to the critique of the potential anti-intellectualism associated with Lave's and Wenger's (1991) and Schön's (1983, 2001) works. Activity and situated practice are central to his argument, but he is aware that the point of learning is building of concepts and relations between concepts with which a worker generalises beyond particular situations. The question of generalisation has not been answered by practice theorists, the issue of how what one learns through immersion in a practice or through doing tasks with the technologies at hand and with other people, becomes generalisable, is not answered. The terms *mediation* and *inferring* are at the centre of Guile's thesis of building concepts and generalisations. Participations in social practices of different kinds, he says, is not context specific because any human experiences is already 'clothed' with concepts. Guile draws on the American philosopher of mind and language, Robert Brandom, for his analysis of inferencing and the famous Russian psychologist Lev Vygotsky's theory of mediation. He borrows from McDowell's (1966) the idea of 'the unboundedness of the conceptual' and from Sellars (1997) the notion of 'space of reasons' or the idea that our engagement with the world is purposeful and involves some or other form of evaluation. A central argument in Guile's thesis is that the idea that theory and practice form a split that needs to be bridged flies in the face of human experience which is characterised by "the unboundedness of the conceptual". Experience is always mediated as it is already conceptualised (McDowell 1996 in Guile, 2010, p. 132). In a different paper, Guiles explains:

> the unboundedness of the conceptual enables us to appreciate why we inhabit a mediated environment where we engage in intellectual or political debates, social events or work processes that are, in many instances, characterised by the *commingling* of the theoretical

> and everyday, rather than moving between separate conceptual and practical spheres. (Guile, 2014, p. 80 my addition)

The idea that "experience is already conceptualised" means that doing, performing a task, practicing a procedure are mediated by words, ideas, concepts, reasons, symbols and the like. Three traditions supply concepts to professionals - disciplinary, professional and everyday (Guile, 2010, p. 141). Workers grow their understanding of those concepts through the continuous verbal interactions with others about tangible and intangible aspects of the practice:

> This involves a process of inferring, in other words, working out what follows from the tangible aspects of practice, such as conversations, instructions, access to technologies, and other dimensions of the work context, and what might follow from the intangible aspects of practice, such as ideas that crop up during, after, or outside the work process. (Guile & Unwin, 2019, p. 34)

This discursive activity teaches workers important aspects of professional knowledge—"forming inferences from concepts and actions and determining what follows as a result" (Guile, 2010, p. 139). In this way workers' "space of reasons" expands—when they approach the same activity at a later stage their conceptual understanding has become wider. They are able to give more reasons for what they do, they are able to explain themselves clearer, they are able to draw more implications and include a range of similar interactions in their explanations. They are also able to draw limits from their thinking and say what cannot be inferred or under what circumstances their inference won't apply. Their activity has been expanded as the range of inferences about it and from it (to another object) is wider (2010, p. 139). Workers' engagement with the activity is more accurate as they are able to select the (more) exact knowledge they need from the wider range accumulated in the three traditions of knowledge. Overtime, with more encounters with objects of activity, their conceptual web of their professional knowledge becomes more complex and more relational—they can see more relations and more distinctions about the object of their activity, can "navigate perspectives" and change certain aspects about their practice. When workers form connections between concepts (able to grasp higher levels of abstractions) they are able to appreciate "aspects of practice that are not immediately detectable through sensory perception, and the contradictions or tensions associated with concepts or the field of which it is a part" (2010, p. 149). In other words, through this form of mediation in which reasons, explanations and inferences are made, professional knowledge becomes wider, more abstract and more differentiated.

The social activity theory suggests that learning is not a linear process. Learning is

- based on different types and sources of knowledge (disciplinary, professional an everyday);
- develops in and through practice, interaction with technologies and with other minds, and
- inferring and justification are central to learning in and through practice.

The question of generalisation and inferencing has always been an important question in professional work, but with the changes of workplaces organisation and labour process, Guile and Unwin argue (2019) generalisation has become even more important. This has implication for work place learning during or after professional education.

In a recent paper David Guile and Loran Unwin (2019) argue that the introduction of cognitive technologies has changed work organisation profoundly. Workplaces are not organised around one key occupation and a set of machinery (tangible assets) and workers are working across variety of practices. Both the means of production and social relations of production have been transformed. The means of production are no longer concentrated in fixed capital infrastructure (machinery) but in what is called "Internet of things" which is a whole lot of different kinds of cognitive technologies put together to produce Big Data. In the 2020s, it is clear that IoTs can radically beef up businesses and governments, by networking things like inventory control, transportation, shipping, security, energy conservation, urban waste management etcetera. Modern workplaces are structured as an 'ecosystem' of analytic tools. Other terms Guile and Unwin use to describe these novel interconnected environments include *collaborative commons*, *intracommunities* and also intercommunities of work, and *platforms* or "digital infrastructures which enable two or more groups to interact" (2019, p. 26).

> Because people are working across practices (some are more tangible and some are symbolic), they require *prospective* way of thinking, an analytical thinking of the kind that "can manipulate and interpret data, solve problems, and interact with the world outside their immediate workplace, wherever that may be. (2019, p. 25)

Guile and Unwin are looking at the technological changes at work and argue that the social relations of production have changed. The idea of individual notion of expertise is wrong for two reasons. It is based on a wrong theory of learning and it does not recognise the radical changes of work organisation. If one accepts that learning is nonlinear and work organisation is more like an ecosystem (more on this in View 5 below) rather than a top-down hierarchy of

people, they can agree that decisions in the workplace are not made by individuals in an individual isolated way. Decisions are made relationally and that means that we have to re think our idea of expertise as a network of relationships. The idea that expertise is relational has some implications for the kind of mentoring and support one needs in workplace learning. They will need support on

- how theories or concepts learned in an educational context that pertain to their occupational field manifest themselves in artifacts, routines, and conundrums in a workplace context, and vice versa;
- how to vary their approach to artifacts, routines, and problems when they are involved with specialists from other occupational fields; and
- how to justify the judgments or recommendations they make to members of their own and other occupational fields. (Guile & Unwin, 2019, p. 35)

Can this support be given by experts during practice? Which of the above can only be taught by formal instruction? How does one distinguish between artifacts, routines, and problems in terms of their level of complexity? These are the kinds of questions which Guile leaves unanswered and which begs a discussion of the structure of professional knowledge.

Until this point, our brief was focussed on practice theorists whose view about professional education is derived from their focus on the act of knowing and learning. All the positions we covered above argue that workers learn through practice. In epistemic terms this view sees learning as an inductive process. We ended with the work of Guile who tries to answer the question of generalisation but who does not distinguish learning from what he calls the everyday tradition from learning from disciplinary and/or from professional traditions of professional knowledge. In other words, despite his effort to explain the development of conceptual knowledge (generalisable knowledge) his analysis does not shed light on the differences between everyday and specialized knowledge. All learning is situated in social practice and although the practice includes different means of knowledge distribution, learning remains a process of building from the particular to the general.

We turn to Christopher Winch, a British philosopher of Education, who has been writing extensively on professional knowledge and like others is concerned to show the relations between formal and practical knowledge. He offers the term *applied theoretical knowledge* and on the basis of his analysis of different kinds of practical knowledge shows why any form of work-based

training needs to be tightly structured if it is to be successful. We review Winch's work and include a few comments about the work of Andrew Abbott (an American sociologist) to bring into focus *professional knowledge* and not professional knowing or learning. Both represent for us literature that arose against the danger of anti-intellectualism, by reducing the importance of systematically produced formal professional knowledge which includes scientific disciplines, procedures, case studies, rules of ethics and the like.

View 4: The knowledge view

A fresh starting point to the discussion of professional education is Winch's claim that to a greater or lesser degree every profession has large bodies of knowledge which can be applied to a range of situations (Clarke & Winch, 2004; Winch, 2010). This is knowledge which has been developed and tested in different contexts and times and can be applied to a large number of instances, even if some or other kinds of modifications are needed. And although the strength of professional knowledge differs across different professions there is still a critical difference between everyday working knowledge and professional knowledge (Winch, 2010, p. 103) in all the professions. The former is discrete and is contingent upon many specific (nongeneralizable) conditions and factors; The latter is systematic and organised (generalisable).

Winch explains that the heart of expertise lies in the ability to recognise a situation as an *instance* of systematically deduced knowledge. In common language, people use the notion of skill to describe one as an expert. They use expressions such as 's/he has the skill' or 's/he is skilful'. Winch argues that skill is not synonymous with expertise. While the notion of skill can be applied to simple and highly circumscribed activities, expertise is much broader. A worker shows expertise when s/he knows in practice how to do something and has the knowledge of *a way of doing that* , is able to recall the process, explain and justify why *that way* is suitable for the instance. This does not mean that *the way* the worker selected is the only way to deal with the instance. It may not be. But if *the way* which was selected forms a part of "a properly constructed theory" it "will be as complete as it is reasonably possible to make [a generalization]"(Clarke & Winch, 2004, p. 517). Being able to select, perform and justify (if requested) *a way of doing that* and over time performing *that way* with more confidence and fluency are all signs of development. Experts know what can and what cannot be inferred to the particular situation from the bodies of knowledge they acquire by formal instruction as well as what can and what cannot be inferred from the situation to other cases and contexts. Winch's term for this is 'inferential comprehension' – mastering of knowledge by means of continual creation of inferential

relationship between propositions (statements of idea). Both Guile and Winch give importance to the process of inferences, which they drew from Robert Brandom. But their starting points are very different. Guile argues that inferences are constructed in practice, with all the different resources available in practice (technology, old timers, disciplinary, professional and everyday knowledge). Winch argues that inferences are constructed systematically in formal setting, they are organised in bodies of knowledge and then deduced into a class of cases. The point about learning to apply a theory, Winch argues, is that the learner

> has got to be able to recognise contexts to which the theory *applies* and those to which it does not. This requires both knowledge of the theory and ability to recognise the contexts in which it does apply. (Clarke & Winch, 2004, p. 517 my addition)

Because professional knowledge has a systematic structure (to a greater and lesser degree) and because that knowledge acts on the world, professionals apply their knowledge constantly and continuously by firstly looking inwardly into their reservoir of propositions and then outwardly into the case in question. The inward looking is done through the act of "inferential comprehension". The outward looking is done through application. Both are types of practical knowledge (knowing how), albeit of the epistemic sort. The former is inferential and the latter is referential. Together they form what experts do—produce professional judgment. This is for Winch a very important principle for vocational education:

> … a system of vocational education that explicitly develops a capacity for action on the basis, first of the acquisition of systematic knowledge and then its conscious application in judgement and action, presupposes that the agents themselves should be able to give an account of what they are doing. The premise of such a system of education is that it is because they apply systematically organized propositional knowledge that they are successful in action. *The possession of relevant systematically organized knowledge is not a by-product of the action, but a prerequisite*. (Winch, 2010, pp. 102–103 my emphasis)

Sometimes knowledge application is not sufficient (it is necessary but is not sufficient)—the worker needs to improvise. The worker knows *a way of doing that* (she has acquired systematic knowledge) but in the process of applying *that way*, the worker can see that some adaptation and change are needed. At other times, the professional does not have the knowledge of *a way of doing that* - she needs to search *a way of doing that* or a solution to a problem they did not encounter before. They need to problem-solve, in other words. But in most cases the reservoir of systematically acquired bodies of knowledge guides professionals when they come across

particular instances. It helps them to recognise that X is an instance of *that way* and if needed, they find ways to improvise in order to adapt to the specific situation.

It is the relation between the specific instance and the general that Andrew Abbott (1988) developed about professional knowledge and that we would like to bring here, albeit, in a short note (See more Shalem, 2014). Professions enjoy two reservoirs of knowledge, argues Abbott - academic and diagnostic. Both are formal bodies of knowledge but each is organized differently and frames and guides professional judgement differently. Academic knowledge classifications pull together propositions, formally, and produce relations and boundaries between ideas. They create concepts, big ideas, theories. Concepts such as "particle interactions" or "underwriting" provide stronger classifications because they can only be explained by a singular discipline (Physics and Actuarial Theory, respectively). Having these kinds of distinctive concepts gives strength to professions or in Abbott's words, it secures the "jurisdiction of judgement" within the profession. Jurisdiction does not mean that the meaning of concepts is not debated. It does mean, however, that the concepts are exclusive to the professional knowledge of that specific profession. Degrees of specialization of content are central resources for the exclusivity claimed by professionals. In Abbott's terms: "No one tries to explain particle interactions without mastering the abstract knowledge of physics. More practically, no one offers insurance companies advice on underwriting without having mastered actuarial theory" (Abbott, 1988, p. 103). The second reservoir of professional knowledge is "diagnostic classifications" (1988, p. 53). These classifications form a far more direct resource for the working knowledge of professionals, yet do not always lend themselves to a "standard sequence of questions" (1988, p. 42). They are not tips, routine skills or direct commands.

Abbott explains the way in which professionals draw on the two reservoirs of knowledge. First, they collect information about a particular case (be it a specific disease, legal case, a building design in architecture or learners' errors in an exam) and assemble it into a complex picture, according to certain epistemic rules and criteria specific to the subject matter (this is an inductive process). Second, the practitioner takes the complex picture and refers it to classifications that are already known to the profession (for example, a concept in the field of law, a formal theory in architecture or a set of conceptions in a particular area of science or mathematics), and deduces the type of the case in particular (this is a deductive process). In order to align the case with the concept, professionals sift between the evidence and choose that which is most relevant and valid and rule out unacceptable levels of ambiguity. The process of building a case from

different information relies on having access to a reservoir of deductive propositions or theoretical concepts that directs the professional's attention to specific features of the particular. Access to this reservoir of knowledge enables attention in at least two ways. First, it enables the professional to "diagnose away" (Abbott, 1988, p. 41) what is not relevant for the case, although this is a complex matter, which is often subjected to a few trials. Secondly, a practitioner who understands the subject matter they deal with (its academic classifications) would know to distinguish between less or more reliable evidence. This kind of evaluation cannot be achieved by following a "standard sequence of questions" (ibid., 1988) or by observing and reflecting. Some of these deductions are faster and easier, when the problem involved in the task is familiar and its solutions have been worked out before. This is sometime termed as Standard Operating Procedure (Gamble, 2018) or mechanical specialisation (Freidson, 2001) or routine skills. When the problem is novel, inferential reasoning precedes the selection of the routine before a solution is applied (Clarke & Winch, 2004, p. 517; Freidson, 2001, p. 111; Gamble, 2018, p. 39).

View 4: Skills Eco-systems

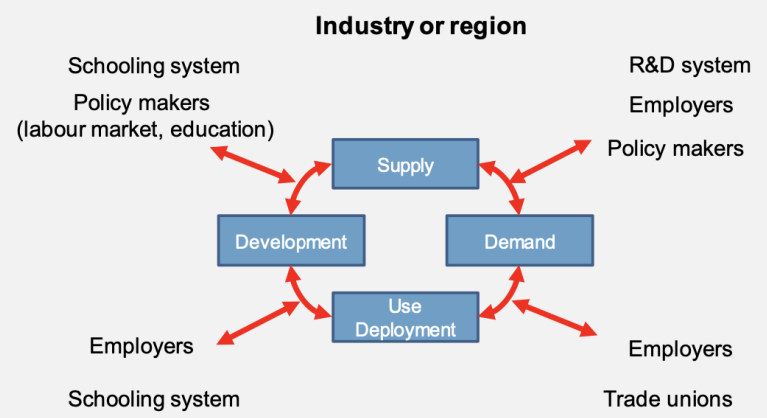
A more recent body of work which focuses on more local/regional demand-side behaviour as critical to worker education is the 'skills ecosystem' literature. The "skills ecosystem" concept which was developed by authors such as (Finegold, 1999), (Buchanan et al., 2001), (Windsor & Alcorso, 2008) and (Buchanan & Jakubauskas, 2010), offer one of the more useful frameworks for analysing regional systems of skills training. At its most basic, a skills ecosystem is akin to a biological system, with all separate parts connected, interdependent and working together in order to function well as a whole. Finegold (1999) who was working within the IT and biomedical sectors of Silicon Valley in California, coined the term 'skills ecosystem' to describe the actors and institutions, and the complex relationships between them, that seemed to successfully deliver local skill needs. Finegold further argued, that the main way professionals and technicians developed their skills was through informal means such as working with others in their networks to overcome technical challenges. He thus positions skill ecosystem as a distinct organizational form which facilitated this mode of knowledge creation and diffusion between regional knowledge stakeholders.

The OECD furthermore defines local skills ecosystems as 'organisations, institutions and firms in a certain local area or labour market that constitute area-based partnerships for training and skills development' (OECD, 2012a: 31). It identifies skills eco-systems as the ideal organizational form within which to understand and promote local and regional development:

> *... local skills partnerships are not just for providing skills, they are for knowledge exchange as well. Local partnerships in training have advantages in that local agents are better able to develop skills that meet their specific needs, increase knowledge flows and information within communities, drive local innovation through new ideas, utilise local knowledge, develop capabilities and skills and common ownership, increase transparency and accountability, and supplement limited resources of the formal education and training system (OECD, 2012a: 31).*

The 'skills ecosystem' is thus a dynamic concept that recognises the intersection of low, intermediate and high skill segments in a system, and the need for their continual inter-development.

Reflecting on the development of a skills ecosystem for the rail sector in Australia, Dhondt et al (2019) construct their skills ecosystems as made up of stakeholders from four areas who actively collaborate in supporting as depicted in Figure 1 below:



A skills ecosystems perspective on skill: elements and stakeholders

The figure above shows the importance of the interdependence of actors in the system and the continuous evolution of the system through processes of growth, survival or extinction (Finegold, 1999). The ecosystem concept stresses not only the issue of skills development (a supply-side phenomenon) but also and perhaps more importantly for workforce development, skills deployment and utilization (a demand-side employer responsibility). This perspective thus enables us to argue that in supporting stronger relationships between education and work companies and sectors need a broader strategy to deal with changing educational demands. These core focus areas (as depicted in figure 1 above) are embedded in a configuration of institutions consisting of interconnected actors, roles, needs and resources. The process of

change in which these institutions operate influence these four areas in any given industry or region.

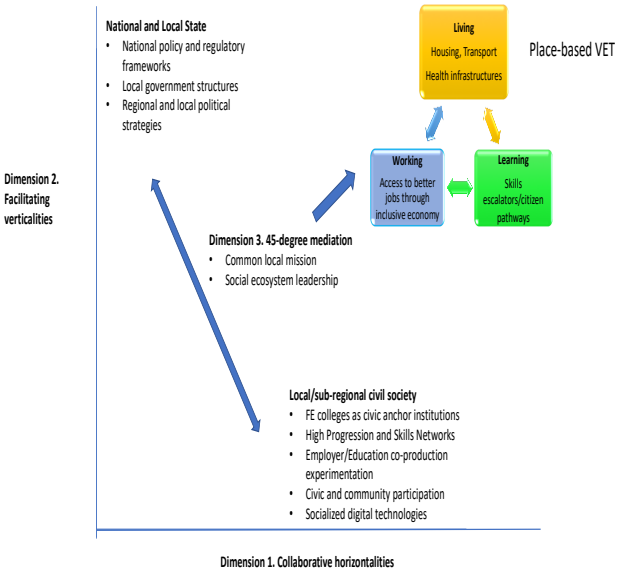
Another core insight the ecosystem literature enables us to highlight is the need to address the range of contextual factors that shape approaches to skill formation and usage within a particular ecosystem, the wider array of determinants associated with workforce development and how workforce development is connected with trajectories of social and economic development**.** This diversity within systems is important to recognise, Wheelahan (2015) explains 'the skills ecosystems approach helps to identify diversity within nations and between regions and industries (Buchanan et al. 2001). This is why regarding employment and educational logics as tendencies rather than iron-clad logics is more helpful in understanding the links between education and the labour market. Different skills ecosystems have different approaches to the development of skill, the deployment of labour, and the relationships between social institutions. ….. The skills ecosystems approach shows that, while the relationship between the education system and labour market within a nation overall may be dominated by an employment or educational logic, there may be pockets where different logics predominate' (Wheelahan, 2015)

Policy built on skill ecosystem thinking is complex and dynamic. The skills ecosystem approach reflects that reality and seeks to align policy with practice. For skills ecosystems to work effectively the evidence suggests that:

- a broad range of stakeholders and partners need to be involved;
- the establishment of systems for dialogue between different policy communities;
- employer engagement has to be achieved;
- with formal, intentional initiatives, codification of policy aims and agreement about actors' roles, responsibilities and resource inputs is important;
- opportunities for frequent informal and formal co-operation, exchange and networking need to exist;
- knowledgeable and entrepreneurial intermediaries are needed to engage and coordinate the stakeholders and partners.
- Focusing VET policy-makers on improved collaboration
- creating policymaking systems which transcend the boundaries of established policy 'silos'
- Constructing better systems for information exchange between VET and other horizontally linked policy areas (Kraak course notes; Buchanan et al, 2001: 27).

A further development within the skills ecosystem literature, is the recent work of Spours, 2018. The models of 'skills ecosystem' developed out of the work of Finegold referred to above, have been critiqued for being elitist given their genesis and application contexts, and in response, a 'social ecosystem' model has been developed by Hodgson & Spours, 2018)
which "envisages bringing together of a wide range of social partners around the relationship between working, living and learning"' favouring and offering a more inclusive model of social collaboration that sees "a particular role for local anchor institutions, such as further education colleges, that can facilitate 'citizen pathways' to new jobs and sustainable living" (Lotz Sisitka, 2020). Theorists of this model argue that there is need to develop experimental platforms "for collaborative working between important social partners from which lessons can be learned in building the larger long-term social formation" (ibid) indicating that development of such approaches require collaborative, place-based engagement with multiple actors over time

… human ecosystem thinking has the potential to help us to understand how different social actors can come together to create dynamic clusters of economic, social and sustainable activity. Seen in this way, human ecosystem thinking could also be viewed as leading to a different model of the state and economy beyond the increasingly worn-out neoliberal binaries of marketization and managerial state, and as a movement towards a more collaborative, devolved, networked and civil society concept of governance and leadership. At a broader ethico-political level still, human ecosystem thinking is also underpinned by a growing awareness of the enormous challenge of sustainability and the crisis of the relationship between humanity and the planet and, in this sense, it can be seen as a representation of the current zeitgeist (Hodgson and Spours, 2018, pg. 6).



In order to build an inclusive social ecosystem model, these ecosystem 'elements' have been extended along three dimensions – horizontal terrain, vertical structures and a mediating dimension of 45-degree relations (see Figure 2).

Spours argues that social ecosystemic skills research should involve what he calls "45 degree activity" at the interface of 'facilitating verticalities' and 'collaborative horizontalities' (see Figure 2).

Spours argues that this non-linear approach to causal analysis, enables connecting work and learning to living, and facilitates a concern with workforce development at all levels of an ecosystem.

Part III

Implications for curriculum design:

Curriculum for formal instruction

The question we pose in this section is: What kinds of curricula are valuable educationally in programmes that aim to prepare people for work (Shalem & Allais, 2018b). We ask this question because much vocational education in the liberal market economies of the English speaking world has been narrowly focused on short-term preparation for tasks in the workplace, based on employer specifications (Allais, 2014; Gamble, 2018; Wheelahan, 2010; Winch, 2013a). Programmes are structured by what John Buchanan, Simon Marginson, and Leesa Wheelahan (Buchanan et al., 2009, p. 3) refer to as ad hoc clusters of highly fragmented units of competence tied to specific tasks. This means that novice workers "are denied access to education that will allow them to handle abstract knowledge and truly develop analytical capacity and other transferable skills". Shalem and Allais (2018b) interrogated two curriculum documents of senior secondary school subjects (tourism, business studies) and show the extent to which the competence-based logic which curriculum designers follow (all TVET curricula follow this logic) fragment knowledge into skills and tasks. It is clear that a curriculum which is structured around tasks lacks conceptual logic of the body of knowledge which underpins those tasks. Those kind of curricula offer no more than 'isolable items of knowledge', like pebbles one would collect on the beach, as one of the greatest curriculum theorists in our times, Paul Hirst, has once said (1971, p. 237).

One example will suffice here (taken from the business studies curriculum). The curriculum statement is ordered around eight functions and activities which businesses do (general management, purchasing, production, marketing, public relations, human resources, administration and financing). Topics are not distinguished or sequenced in any particular way.

For example, "inequality and poverty" is listed under "contemporary socio-economic issues" but is expected to be taught in the same two weeks in which "gambling", "piracy", "bootlegging", "violence" and "crime" are taught (Shalem & Allais, 2018b, p. 16). Needless to say, that the topic of 'inequality and poverty' has nothing in common with "gambling", "piracy", "bootlegging" or "crime". "Inequality and poverty" are social phenomena which are explained by a set of inferences which are based in socio-historical facts and events. Their explanation is primarily sociological; it relies on the validation of empirically provable propositions. The other four topics involve an analysis of the moral character of the action, the intention behind the action, and some legal knowledge. Lists of statements or of topics which have no conceptual relations (as they derived from skills required for a task and not from bodies of knowledge) do not have a way to show what concepts are key to a field, what activities are worthwhile and what texts are worthwhile. It is questionable that a curriculum which puts together topics that have no inferential relations will succeed in developing inferential judgement in novices.

> Intended to mirror everyday life experiences which a business person might encounter, this ad hoc arrangement of topics does not offer TVET students the opportunity to acquire meaningful and valid knowledge. It does not show them that these topics are of a different logical order and that the procedure of validation is radically different. (Shalem & Allais, 2018b, p. 24)

A curriculum for professional formation builds opportunities to formally learn a variety of types of overarching concepts. In this we claim that

> teaching bodies of knowledge is not something to be contrasted with preparation for 'the real world of work', but is an essential component of it. Unless one is intending to teach common sense beliefs and dogmas, one needs to think carefully about the truthfulness of what is being taught; how an idea was theorised, proved or falsified; and how a technique was formed – what logic frames it and in what circumstances it could be applied. (Shalem & Allais, 2018b, p. 22)

A curriculum for professional education selects concepts, practices, procedures and routines which have been researched withing the framework of the disciplines that inform the knowledge area of the occupation. It also selects instances (situationally specific knowledge), some of which have/not undergone systematic investigation. In short, a good curriculum offers both discipline and working knowledge. There are three aspects to this selection. First, when a professional curriculum is designed through a collaboration with a variety of stakeholders, curriculum

coherence cannot be compromised. This is a complicated process as different interests and beliefs have to be balanced. A centralised curriculum which is dictated from above by government and which is translated to one compulsory textbook (this seems to be the common practice is TVET) appears to solve the possible contestations mentioned above but in fact, relies on strong subject matter knowledge of TVET educators, particularly if it follows a competence-based approach. Second, subject matter can be judged as worth while even if does not apply directly to occupational knowledge. General subject matter broadens the knowledge of novices which has an important educational aim of understanding the social world in which the occupation forms part. Acquiring general subject knowledge can lead novices to aspire for a good balance between the technical and moral considerations they need to take into account with their objects at work and/or during social interactions with other people in their daily activities. Third, formal instruction does not preclude explicit engagement with practical knowledge. Demonstrations, simulations, setting up hypothetical situations for a careful analysis are some of the ways in which applied theoretical knowledge is enacted in formal instruction.

Structured work-based learning

Winch's and Abbott's views of professional knowledge are in direct opposite to the view of embodiment or reflection which argues that a person constructs *a way of doing something* from experience. What are the limitations of the idea of "learning from experience"?

1. Experience does not produce principled knowledge.
2. Experience cannot provide sufficiently adequate empirical base on which to form appropriate generalisations.
3. In experience we come across 'instances of a concept'; How will we know that this is an instance of, unless we grasped the concept first? What if the instance is an instance of a range of concepts?
4. What if our inference is incorrect or incomplete? The scope and accuracy of the generalisation is in the hands of an old timer who might use an ad hoc form of generalisation.
5. If we learn the concept through experience, how would we know what is context specific and what is not? One needs to have a very good handle of the context which a novice does not have usually.
6. Also, one needs to think about 'high stake situations' and how those can limit the participation of a novice worker:

> This will be especially the case when it is a high-stakes situation where the consequences of failure or less than optimum performance can be serious and damaging, and where the time-constrained flow of an operational situation leaves little room for reflection, correction or a margin of error. (Clarke and Winch 2004 p519)

If we accept that the essential part of a professional education is to develop professional judgement, then the notion of learning from experience needs to be seen very differently according to Winch. The first conclusion from that is that workplace-based learning offers novice workers opportunities to encounter variety of situations *but not to discover or build theories*. Knowledge application starts first by recognising a situation as an instance in a practical setting of a theory. The theory (generalisation) was constructed by specialists and understanding it includes knowing the context and the instance to which it does/does not apply. Assuming that the formal curriculum is well designed, when one learns deductively their learning is more valid and reliable; it is guided by specialists who use "well-tried forms of scientific methods rather than ad hoc generalisations by non-specialists" (Clarke & Winch, 2004, p. 517). Their learning is more powerful, economical and includes predictive generalisations. The key propositions and the logical structure of the theory, are clearly laid out for them as well as the exceptions to the rules. In this way novice professionals learn when and where and why a theory (a generalisation) applies or not.

On the basis of their deductive view of expertise development, Clark and Winch (2004) want a particular form of work-based learning, one that will provide ordering principles for the practical wisdom a novice worker is expected to learn through practice. Learners' experiences have to be ordered and structured for them. Taking authentic experience seriously means taking the problem seriously by first consulting theory then forming hypotheses then testing them, and then revising them, etc. In situations which are not novel, theories are present at the background and one can find that out by asking the novice worker to explain and justify what they do. A worker who is well versed in the theory will be able to explain and justify well what s/he were doing. But precisely because workplaces are organised functionally (to suit the logic of production or service etc) and the pace of actions is much rapid than the controlled environment of formal instruction, a novice worker needs instructional supervision on things such as noticing change in the order of objects, discerning details, guiding on what to anticipate in an evolving

situation (or of an instance), deliberately injecting a different theoretical perspective in analysing the instance (Winch, 2016, 2017).

> The ability to spot detail is a fundamental part of the work of many occupations and it is frequently the case that sustained ability to discern detail in a situation or representation is critical to the development of expertise in a particular area. …the ability to spot detail in a rapidly evolving situation… leads readily to anticipation of what is likely to happen next, that takes the observer beyond the mere seeing of the detail. (Winch, 2017, p. 678)

Fine discrimination does not happen experientially; it has to be framed linguistically through discursive interventions by a specialist-mentor and requires careful planning of a range of instances (in a form of activities) order in a deliberate sequence. These points about experience prove why learning through practice starts in controlled environments with simulations and replication of activities at a different level of complexity and is followed by workplace which is organised and structured to enable deductive learning as far as possible in which reasoning and inferentially are consciously and explicitly constructed by the mentor expert. Over time this kind of sequence will build one's confidence in "embedding of theoretically informed action in practice":

> The aim of learning to apply theories in practice involves the identification and solution of problems explicable by the theory, in which the situations encountered are often novel, then the confident embedding of theoretically informed action in practice. Acquisition of that confidence is likely to be a long process that may ultimately result in a reduction of the need for the conscious construction of trains of reasoning resulting in judgement. (Clarke & Winch, 2004, p. 511)

This does not mean that all application of knowledge is on the same level of complexity and so Winch draws a distinction between three levels of complexity of applied knowledge (of knowing how to do something). Winch draws a useful distinction between exercising techniques and develop polymorphous abilities (which can grow up to the third level of project management). This is a useful distinction for thinking about the kind of structured mentoring a novice would need during work-based training.

Exercising a technique: the object of the activity is relatively bounded in two dimensions—the task itself and the range of contexts in which it is practised. The more the routines of the task have been operationalised and procedures have been agreed, the easier it will be to exercise the task, even across different workplaces. The focus is on the actual procedure needed to be

exercised for the task to be completed. But since a procedure is exercised, the reference to the knowledge that is needed to exercise the task goes beyond mere description of technique. Practical knowledge here also includes tacit dimensions of the technique. It also refers to attitudes displayed by the worker when exercising the task (Winch, 2013b, p. 290). This practical knowledge depends on small pieces of information and does not require complex deliberations (technical or moral).

Polymorphous abilities: the emphasis here is on a range of abilities which are not connected with a task but rather with longer episodes of agency that are manifested differently in different types of tasks:

> For lack of a better term I will call these **projects**, or activities that demand intentional action over an extended period of time, involving the carrying out of articulated sequences of tasks in the pursuit of a larger goal such as the production of an artefact or service. Key forms of know-how here are: planning, controlling, coordinating, communicating and evaluating. (Winch, 2013b, p. 288 emphasis in the original)

The point is that a range of abilities are connected with a bigger purpose. This practical knowledge is more complex because it is not enacted by a routine, it changes in form and complexity in different contexts and contains multiple techniques, which are not delimited. For example, planning something includes "drawing, discussing, soliloquising, writing notes and so on" (Winch, 2013b, p. 290) and each of these consists of different tasks (and standards of excellence).

It goes without saying that learning to exercise technique is of difficult form and level than developing Polymorphous abilities. This in turn shows that work-based learning is not about experience and has to be planned, structured and developed by expert trainers.

Conclusions: 10 claims to take out from this brief

1. Whilst there is a consensus that education in necessary for preparation and for development of occupational workers there is debate on what form of training is more meaningful, educationally, and more productive in terms of improvement of work.
2. Education and work are organised differently. Knowledge is used in both but in very differently modes. Knowledge produced in the sphere of education is radically different from the specific and discrete forms of everyday working knowledge
3. Qualifications are intended to function as an institutional means to create an interface between education and work by structuring the supply of labour in line with market

demands. In informal marker and for less regulated occupations employers use qualifications as a proxy for general ability to learn and of social attributes rather than as indicators of the knowledge they seek candidates to apply in the workplace.

4. The dual system practiced in Germany and other countries in Northern Europe is recommended. Most of the apprenticeships in Africa are informal and are tied to the dominance of informal employment
5. Many educational reformers argue on pragmatic grounds that by strengthening the relationship between education and the everyday world of work, education is better placed to prepare learners for a fast-changing social and economic life. With this there is a growing demand for more work place experience. It is argued that the overemphasis by practice theorists on experience, tacit knowledge, intuitive judgement, fluency and embodiment have contributed to the growing of anti-intellectualism in the approach to professional education and/or professional development. Knowledge of concepts or knowledge that can be generalised is backgrounded and everyday reflection which is bitty, situated and too specific is foregrounded
6. The social activity theory offered by David Guile to addresses the question of generalisation. It offers ideas such as 'inferences' and 'expansive learning' to explain the growth of knowledge but it does not distinguish between every day, professional disciplinary learning or between every day and specialized knowledge. This poses serious limitations on learning from work which remains inducive and unstructured.
7. Professional knowledge acts on the world but it has a systematic structures and is developed by natural and social scientists into bodies of knowledge. Following Winch who argues that "the possession of relevant systematically organized knowledge is not a by-product of the action", but a prerequisite helps understand the advantages of deductive learning but also the absolute necessity to develop trainers, structure work based learning sequentially and use formal instruction to provide theories which novices hold on to when they encounter the variety of instances in their work based training.
8. Critical in contemplating the skills ecosystem body of literature is to recognise, while the notion of skills in context has intuitive appeal, context is not neutral or self evident so it is critical to pay attention to content as well as context. Analysis and reform in skills analysis is needed as most skill problems are not issues in an essentially sound context, most arise from the ways skills in demand are defined, used, and developed and have their roots in the nature of work concerned. Thus a broader way of defining analytical problems linked to skills

ecosystems, requires modern notions of occupation and vocation which gives weight to the content as well as context of skill bringing more depth into analysis (Bucannan, et al 2017).

9. There are serious limitations for a competence-based curriculum. Curriculum which is designed around subject matter knowledge ensures a more controlled knowledge selection process, coverage and sequence. Teaching bodies of knowledge is not something to be contrasted with preparation for 'the real world of work', but is an essential component of it. Formal instruction does not exclude experiential knowledge such as simulation, formulation of hypothesis and demonstrations.
10. Workplace-based learning offers novice workers opportunities to encounter variety of situations but not to discover or build theories. Work best training has to combine deductive with inductive learning. Fine discrimination does not happen experientially; it has to be framed linguistically through discursive interventions by a specialist-mentor and requires careful planning of a range of instances (in a form of activities) order in a deliberate sequence. Learning to exercise technique is of difficult form and level than developing Polymorphous abilities.

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