Capturing the elusive: Researching the development of vocational teachers' expertise

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Abstract

This chapter explores how English Further Education (FE) college vocational teachers' expertise is used and developed in practice. Examples are drawn from two research projects. The first focused on the experiences of vocational teachers as they engaged in teaching observations as part of their initial teacher training (ITT). The second centred on the continuous professional development (CPD) activities used by vocational teachers to maintain and refresh their occupational knowledge and expertise. In adopting Cultural Historical Activity Theory (CHAT) and Actor-Network Theory (ANT), respectively, we show how the development of vocational expertise is diffuse and positioned within networks of both people and things. We argue that through our use of ethnographic observations and in-depth interviews, we have developed robust methodological approaches which offer opportunities to not only capture vocational practice in action but also to make such practices visible. We discuss the implications of our research with the aim of rethinking how best to support the development of vocational teachers.

Key words:

Actor-network theory; cultural-historical activity theory; vocational; vocational knowledge; expertise; initial teacher training; further education; ethnography; participant observation

Introduction

The vocational teachers at the centre of the research projects on which this chapter draws were located in Further Education (FE) colleges in England, teaching on vocational courses. [1] In terms of their entry into teaching, and in contrast to a planned professional journey from vocation to teaching, vocational teachers' transitions to colleges are generally described as 'happenstance', with the transition process itself framed by complexity (James and Biesta, 2007; Lucas and Unwin, 2009). This complexity is because whilst initially recruited to colleges on the basis of acknowledged vocational and occupational expertise, vocational experts then undergo a 'process of becoming' a teacher (Colley *et al.*, 2003). This process, for vocational teachers, is epitomized by the development of an acknowledged dual identity (Orr and Simmons, 2010; Bathmaker and Avis, 2005; Robson, 1998). Or, as the commission on adult vocational teaching and learning (CAVTL) describe it, vocational teachers, by the nature of their work with students, need to "…combine occupational and pedagogical expertise". (CAVTL, 2013, 9). That is, they need to face towards both the requirements of their occupation and the learning needs of their students.

Such Janus-like activity requires, in the first instance, a high level of expertise in their occupational area. On bringing this knowledge and expertise into learning environments, the requirement becomes one of developing knowledge and understanding of pedagogic practice. In this endeavor they can be seen to be involved, as Moodie and Wheelahan (2012) have argued, in the reformulation of vocational knowledge from work, where it has mainly a productive function, to a teaching and learning function. Secondly, whilst initially recruited as teachers because of their vocational and occupational expertise, the longer they remain as vocational teachers away from their occupational workplaces, the greater the need to refresh their knowledge of current vocational practice.

Prompted by a culture of standardization, regulation, control and accountability, (see, inter alia, Aubrey and Bell, 2017; Orr, 2013; Avis, 2009; Edward *et al.*, 2007) FE college vocational teachers in England, have been effected by considerable policy attention in the last 20 years. In contrast to the 'benign neglect' (Young *et al.*, 1995) of earlier decades, teachers in FE have,

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[1] Association of Colleges data shows that there were 313 Colleges of Further Education in England, June 2017.

for instance, been subject to mandatory requirements in relation to working towards an array of standards-led Initial Teacher Training (ITT) qualifications introduced in 2001, only to be withdrawn 12 years later (see, inter alia, BIZ, 2012; LLUK, 2006; DfES, 2004). Additionally, between the period 2007-2012, statutory requirements (Statutory Instrument, 2007) were introduced which required teachers to engage with and record 30 hours of Continued Professional Development (CPD), pro rata for part-time staff, and to take up membership of a newly created (now defunct) professional association for teachers in FE, the Institute for Learning (IfL).

However, irrespective of the ebb and flow of policy interventions, how vocational teachers actually navigate the respective complexities of transition and continuous professional development, both at the initial and at later stages of their careers in colleges, has attracted limited academic research and/or policy attention (Lahiff, 2014; Maxwell, 2014; Broad, 2013; Avis *et al.*, 2011). Whilst recent reports in England which focus on Vocational Education and Training (VET) (*cf*, CAVTL, 2013) have identified many examples of excellence in vocational teachers' practice, few, however, capture the intricate ways in which vocational pedagogy is actually developed. Similarly, while reports (DfEBIZ, 2016; DfE, 2011; DfES, 2002; DfES, 2004) point to the importance of 'subject-updating' and vocational relevance, the persistent narrative of CPD in FE has been of colleges providing short staff development workshops for teachers (see for example, Broad, 2012; Villeneuve-Smith, West and Bhinder, 2009).

In response, this chapter sets out to share our insights into how vocational teachers develop pedagogic and vocational expertise. Specifically, it draws on our respective research, the first of which illustrates the ways in which pedagogic expertise for vocational practice is developed through ITT teaching observations (Lahiff, 2017; Lahiff, 2015). The second captures how experienced vocational teachers cross organizational boundaries through following their own trajectories into wider collaborative networks to seek out CPD opportunities that enable them to refresh and further develop vocational expertise (Broad, 2016; Broad, 2015; Broad, 2013). In so doing, this chapter aims, in the first instance, to inform ways of thinking in relation to supporting the development of vocational teachers' expertise. Additionally, we argue that in researching vocational knowledge and the development of expertise, sophisticated methodologies are required to not only cope with the complexities involved in seeing

vocational practice in action, but also to provide appropriate conceptual frameworks which provide useful, analytic lenses.

The chapter starts by examining how we conceptualize vocational knowledge and expertise. Our argument here is that they are inherently complex. They are both shared and developed in practice and so highlights the importance of contextual factors. We draw on socio-cultural theories of workplace learning to shed light on the distinctive nature and characteristics of vocational knowledge and acknowledge that it is tacit and largely uncodified. Drawing on the work of Nespor (1994) we draw attention to the vocational as being temporal and with high levels of currency, rather than static.

This is followed by a focus on the methodological approaches we used to research the development of pedagogic and vocational expertise, which we argue enables us to provide frameworks through which to research and understand vocational knowledge and expertise. To explore the development of pedagogic expertise, Lahiff uses Cultural Historical Activity Theory (CHAT) to model teaching observations and observes vocational teachers 'in situ' to understand the process of development. Whilst Broad, in her research on vocational teachers, uses the conceptual framework of Actor-Network Theory (ANT) which sheds light on the complexity and heterogeneity of the maintenance of expertise and allows a mapping of the pathways and trajectories that vocational teachers follow.

Drawing on our respective research with vocational teachers, we then explore the mechanisms and processes that vocational teachers use to develop their expertise. The purpose of these sections is twofold. Firstly, to illustrate the ways in which vocational teachers' pedagogic expertise is developed at an early stage of occupational transition, through ITT teaching observations (Lahiff, 2017; Lahiff, 2015). Secondly, to illustrate the myriad ways in which experienced vocational teachers engage with CPD activities, including membership of professional associations, through which to maintain and enhance their occupational knowledge (Broad, 2016; Broad, 2015).

From here, we draw the two discussions together by identifying both the common elements in the development of vocational teachers' expertise and the elements that are specific to the development of pedagogic, as opposed to vocational, expertise. We conclude by offering

suggestions in relation to informing the ways of thinking and supporting the development of vocational teachers' expertise.

The development of expertise and the nature of vocational knowledge

The development of expertise has long been discussed in the literature with two main strands of thought evolving. Initially, dominant conceptions of expertise emerged from cognitive psychology where expert knowledge is seen as, "…deeply structured and indexed, thereby permitting successful non-routine problem solving" (Billett, 2001, 435). Within this approach, expertise is understood as residing in the heads of experts and held in an individual's memory. Contrasted to this are conceptions of expertise drawn from theories of workplace learning and by some from social anthropological perspectives. These approaches accept that, unlike conceptions emerging from cognitive psychology, the deployment of knowledge and skills are dependent on situational factors. Lave and Wenger (1991), for instance, refer to expertise as being part of an ongoing movement towards full participation in, and the formation of identity within, a particular community of practice. From this perspective, participation in a particular social practice is, therefore, both the foundation for the development of expertise and the context in which expertise is developed. Emerging from these two perspectives is the conception of expertise which frames this chapter; a conception which sees expertise as being both personal and shared within contextual networks.

The importance of context and the social practices enacted within these is highlighted by Fuller and Unwin (2011) in their discussions of apprenticeship as a model of learning. The working environment, they argued, needs to provide opportunities for the development of expertise through practice with others. This would include the development of "tacit knowledge and skill" (ibid, 37). However, unlike Lave and Wenger (1991), they argue that the apprentice also needs access to types of knowledge and expertise that will enable them to "grow beyond, as well as within, their current job role and sector" (Fuller and Unwin, 2011, 37). In so doing, they signal the inter-relationship of social practice and individual capacity in the development of expertise (Lahiff, 2014). (Lahiff, 2014)

This perspective raises questions related to the nature of vocational knowledge and so we now turn to discussions regarding this and examine what it is that is captured and utilized in

the development of that expertise. A significant problem here is explained by Fuller *et al.* (2003) in that the possession, development and utilization of skills can be 'hidden' and as such has been the focus of much interest. There are debates which argue that vocational knowledge is on the whole tacit, non-formal and largely uncodified (see, *inter alia*, Hordern, 2014; Polanyi, 1967). The concept of tacit knowledge was developed by Polanyi (1967) who determined that there are two forms of knowledge used by vocational experts, codified (theoretical) and tacit (practical). He described tacit knowledge as that which we know but cannot tell. The difficulties with revealing and understanding tacit knowledge is that it resists codification (Livingstone and Guile, 2012). It is incorporeal and thus problematic to capture and examine. Additionally, Kotzee (2012) argues that Schön's work is infused with Polanyi's concept of tacit knowledge. The importance here is that Schön takes further the discussion regarding the hidden nature of tacit knowledge and argues that "[…]we know more than we can tell and more than our behaviours consistently shows." (Schön, 1987, 22). The significance of this 'hiddenness' and of the unknown aspects of vocational knowledge is highlighted by Frankham (2006, 668) when she argues that we cannot, '…break down the apparent component parts of knowledge and understanding and present them as a series of steps to be followed to completion and predetermined outcomes'. She furthers that this is due to the complexity of vocational knowledge in use whereby many clues are used simultaneously when arriving at professional judgement.

Developing Polanyi's conceptual approach, Eraut (2000), in exploring the hidden factors of learning and knowledge in professional work, developed two distinct definitions of knowledge, codified knowledge and personal knowledge. He offers a further complexity to the dual conceptions of vocational expertise explored above and rather than exploring where expertise resides, examines where knowledge resides. Eraut explains that codified, propositional knowledge can be viewed as public knowledge in that it is open to review and control by others. Personal knowledge is an internal resource held by an individual and can be deployed in practice settings. Within Polanyi's original conceptualization of tacit knowledge, both Canning (2008) and Kotzee (2012) suggest that Polanyi sees tacit knowledge as residing within the individual. However, Fox (2000), on drawing on Lave and Wenger (1991) suggests that rather than residing within the heads of individuals, tacit knowledge is situated within communities of practice.

Similarly, Collins (2007), who distinguishes between somatic-limit tacit knowledge (personal) and collective tacit knowledge (shared within networks), uses Polanyi's analogy of riding a pushbike to explain tacit knowledge. He distinguishes between what he terms bike balancing and bicycle-riding proper. Bike balancing is the simple ability to be able to balance and steer whilst bicycle-riding proper brings together a whole host of skills and abilities from negotiating other traffic, rules of the road, other road users and communicating with drivers at busy junctions. This analogy is also used to highlight the importance of context when he explains that, 'bike-riding in Amsterdam is a different matter to bike-riding in London, or Rome, or New York, or Delhi, or Beijing' (Collins 2007, 259). He argues that this complex tacit knowledge, the bicycle riding proper knowledge, 'is located in human collectivities and, therefore, can never be the property of the any one individual' (*Ibid*, 260). This debate thus complements those regarding whether vocational expertise is developed by the individual through shared practice, or subsumed by the individual through engagement in contextual social practices. The latter also accepts that expertise is understood to be distributed (Hutchins and Klausen, 1996).

An additional complexity in understanding vocational knowledge and the development of expertise is highlighted by Broad (2016). Drawing on the work of Nespor (1994), who views learning and knowing as emerging through materialising networks and network practices (Fenwick and Edwards, 2013), Broad argues that vocational knowledge is temporal with high levels of currency. It is in constant development, changing and melding to the specific needs of a particular organizational context and setting. The suggestion is that, when applied to teachers and their continuous professional development, "Teachers use CPD to connect with both historical, traditional aspects of their occupation to refresh their ideas and knowledge, and also with the latest developments." (Broad 2016, 156). This indicates that vocational knowledge is informed not only by current approaches within an occupation but by the rich history that underpins it.

Regardless of the difficulties, understanding what is meant by vocational knowledge is, however, imperative to understanding the development of expertise. Its importance cannot be discounted for a number of reasons. Firstly, as Ashton, (2004) found, much of the knowledge within an organization is tacit and specific to that organization, more succinctly put, it is bound to that particular context. Secondly, Livingstone and Guile (2012) suggest that

within learning organizations, tacit knowledge is increasingly important for the production of new knowledge and thus the most important form of knowledge within learning organizations.

Conceptualising a fuller understanding of the development of expertise also requires cognizance of the significance of the visceral in some vocational contexts (Lahiff, 2014). Darrah's (1996) research into wire-maker operators' practice, illustrates this perfectly.

> *Getting to know the 'feel' of the wire moving through the machine and knowing when a break is likely rather than relying on documentary evidence puts the body rather than the mind in control. Developing a 'sixth sense' of what is possible on which machine and knowing when to make adjustments while maintaining production.*
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> *(Felstead et al., 2005, 363)*

In this extract, 'getting to know the feel of the wire' captures the centrality of the body to the development of aspects of vocational expertise.

In summary, our conception of the development of expertise in vocational contexts confirms that it is a complex and complicated process, much of which is hidden, residing either within the individual as personal expertise and/or within networks as shared knowledge. The nature of vocational knowledge is similarly complex and complicated; it is constantly in motion, temporal and with high levels of currency.

Methodology to explore the development of vocational expertise

In the previous section, we have argued that the development of vocational expertise needs to be understood as a complex and multifaceted activity. Additionally, to aid this understanding the centrality of vocational knowledge to the development of vocational expertise needs to be acknowledged. This complexity is all the more apparent when attention turns to understanding how vocational teachers develop expertise. In developing our respective research projects with novice and experienced vocational teachers, it was essential to ensure that our methodologies reflected the complexity of vocational teachers' practice.

As will become clear in the next section, although we adopted different conceptual frameworks in researching and analysing the development of teachers' vocational expertise, we shared key guiding principles in framing appropriate methodological approaches. The aim of this section is to draw upon the methodologies developed in our respective research projects to argue that it is incumbent upon researchers to develop robust, sophisticated methodologies to capture vocational practice in action in order to understand it. In addition, researchers whose intention is to understand vocational expertise, need to place themselves in the contexts where vocational knowledge is shared and developed and where vocational expertise is honed.

Epistemologically, we were informed by discussions that emerged from contemporary developments in the realm of social theory. Lahiff (2014) found that a realist perspective (following Bhaskar, 1989) offered a helpful insight into preparing to research the nature of social reality in vocational classrooms. This was because prevailing discourse on teaching observations had contributed to the implicit acceptance that, irrespective of the wider framing of teaching observations, a pre-existing classroom reality existed which simply needed 'to be seen' (see, Lahiff, 2017 and 2015 for further discussion). In contrast, a realist perspective accepted that social reality has human and non-human components and exists beyond the individuals who are involved at any point in time. Therefore, whilst we can identify the elements that may exist beyond individuals, i.e. "...the relatively durable materials and practices, carrying cultures and social structures over time", (Parker *et al.*, 2003, 179), we cannot, however, predict how they will come together at any moment. Emergence is the key concept here, where elements come together in unpredictable ways to produce an entirely new phenomenon, which is distinct from its constituent parts. A social realist standpoint was adopted because it recognizes that while vocational classrooms are indeed part of a material reality, what happens when vocational teaching takes place is emergent and the product of social interactions (Lahiff, 2014).

Broad, (2016, 2013, and 2015) adopted a material-semiotic approach, Actor Network Theory (ANT). This approach also acknowledges the importance of recognising both human and non-human actors within a relational network. It offers a range of analytical tools to examine webs of relations between things in the locations where they generate effects. The epistemological insights afforded by ANT establishes that the reality we live with is one

performed by a variety of practices and makes clear that there is no single, natural, or material reality. Reality for ANT is formed through action in the here and now, where performance is defined as 'material processes [and] practices, which take place day by day and minute by minute' (Law and Singleton, 2005, 775). Actor Network Theory, rather than offer theories to why things happen, instead tells stories of how things come together in relations and attempts to offer explanations for the "…messy practices of relationality and materiality of the world." (Law, 2007, 3). Therefore, it offers an alternative to the over simplification of how teacher professional learning is contextualized and situated, and how it is developed and shared. It offers new insights into practice as by adopting a commitment to relationality, it "…makes it possible to explore strange and heterogeneous links and follow surprising actors to equally surprising places. (*ibid*.,7) ANT therefore offered an alternative 'starting point' from which to begin to follow the actions of teachers as they worked to develop their vocational expertise.

These respective epistemological starting points provided a backdrop for our research with vocational teachers. They offered frameworks for exploring the messy and complex nature of both vocational knowledge and the development of expertise.

The starting point for the adoption of a specific methodological framing for Lahiff's research on teaching observations was the following quote from Miettinen (2000, 63):

> *Observation necessarily takes place in a certain activity, context or thought community, using the concepts, instruments and conventions historically developed in that context. They steer the observations, and with them the observer interprets and generalizes what is seen and regarded as problematic and important.*

This led to Cultural Historical Activity Theory (CHAT). CHAT emphasizes that any type of human activity takes place in a context and that the activity has a cultural, social, historical 'memory'. The focus of inquiry is on the purpose of the activity as it will influence the way in which those involved in the activity approach it and use resources and artefacts designed for the purpose. The activity is the prime unit of analysis (Engeström, 2001). CHAT therefore provided a way of modelling and then theorising the complex phenomenon of teaching observation and provided a way to think about the situated nature of teacher development.

Specifically, it offered a lens through which to view observation practices in colleges. Crucial to this modelling were the conceptual tools CHAT provided. This meant that observations could be captured in action having accepted that they were framed by rules and regulations; took place in specific communities; had specific participants (vocational teachers) and observers (education tutors and vocational mentors), defined as subjects in CHAT; and, significantly, involved specific observation artefacts, such as observation proformas and feedback discussions (Lahiff, 2014).

For Broad's research on the CPD activities of vocational teachers, the methodology was framed by ANT's roots in pragmatics which, as Freeman has suggested, means it:

> *…takes place on the ground, as practitioners (including researchers and policy*
> *makers) talk and write about new ways of doing things. (Freeman, 2009, 440)*

A rallying call in ANT is therefore to 'follow the actor' (see, *inter alia*, Mützel, 2009; Latour, 2007; Callon, 1986) wherever that may lead. Significantly, it invites researchers to, "…learn from the actors without imposing any *a priori* distinctions upon them." (Callon and Latour, 1981, 1). Similar to a grounded theory (*cf*, Glaser, 1992; Glaser and Strauss, 1967) informed approach, this signals the imperative of approaching the research site with as blank a slate as possible. The importance of a grounded theory approach is highlighted by Urquhart, Lehmann and Myers (2010, 358) who argue that it "…offers a comprehensive method of theory generation". The importance of this, they argue is that it enables the development of new theories.

Equally, the relational qualities of ANT were important when framing the methodology. As Strathern, (1999, 156) observes, ANT's distinctive offering is, "…in overcoming the descriptive resistance to dealing even-handedly with persons, things, artefacts and so forth together." This approach to relationality and radical symmetry enables all aspects and components within a network to be analysed and thus all actors and entities, all the things that exert power are followed. It decentres the human aspect of the network to enable the emergence of all things that hold influence on action. Therefore, actor webs always consist of both human and nonhumans (Saldanha, 2002). Unique within ANT is this very approach and other analytical approaches ignore the role of non-human things as they are viewed as being different to human things (Waltz, 2006).

Applying these methodological constructs to the framing of the methodology for our respective research projects led to the adoption of specific research methods. These approaches enabled us to enter into the contexts where our respondents worked to develop vocational expertise and are discussed in the following section.

Capturing the development of vocational teachers' expertise

Informed by the methodological and epistemological framing presented in the preceding section, in this section we discuss the methods employed in our respective research projects. In capturing vocational expertise in development, we adopted two central research methods: observation and interviews. As will be seen, central to our rationale is the desire to make visible the processes involved in the development of vocational expertise by providing accounts of the practices undertaken and the perceptions of the participants. We start with case study research into the development of pedagogic expertise.

Capturing vocational teachers' pedagogic expertise

Qualitative multi-case studies were identified as instrumental in the exploration of the processes involved in conducting teaching observations with vocational practitioners in situ. This was because, as Yin (2014, 16) confirms, this approach offers the opportunity to investigate phenomenon "...in depth and within its real-world context". The importance given to the real-world context was central to the adoption of a case study approach in researching the processes involved in teaching observations.

As has been outlined above, CHAT provided a helpful methodological framing for the research. Therefore, teaching observations were identified, heuristically, as an activity and, therefore, were the prime unit of analysis (Engeström, 2001). Given this framing, the participants in the research (or 'subjects' in CHAT) were identified in relation to their participation in the activity. All of these took part in the activity of teaching observation due to their relationship to a specific vocational teacher who was following a part-time initial teacher training (ITT) course for FE teachers. Six vocational teachers on ITT courses across south east England agreed to become involved in the research (see Lahiff, 2014, for further

discussion). Once their participation was secured, other participants in the activity of teaching observation, their vocational mentors and educational tutor-observers, completed the sample (n=18).

The overall research aims were to consider the use and value of teaching observations conducted as part of ITT for vocational teachers. As has been argued elsewhere Lahiff (2017; 2015), teaching observations conducted as part of ITT have, largely, been construed as developmental. However, research had not focussed on the ways in which that development occurred and had not centred discussions on the development of the vocational teacher. A prime concern of the research was to therefore to identify the processes involved in ITT observations for vocational teachers; to make processes visible and provide accounts of the practices undertaken. Given these prime considerations, observation of practices that make up the activity, plus interviews with subjects in the activity system became the methods used in the research.

In researching vocational teacher's observation, an "unobtrusive observer" role (Robson, 2002, 309) was adopted at two key points in the observation process: the teaching event itself and during the feedback discussion which took place after the teaching observation. For the former, a temporal narrative captured the sequence of events and a record made of the physical, visceral actions in relation to both the process of observation as well as the relationship to the physical environment. Ethical considerations ruled out the visual recording of the teaching context, therefore sketches of the vocational context were made. These acted as a visual reminder of the environment in which the observations were conducted and this visual record proved central to capturing the physical context. Diagrams were later interspersed in the case study accounts and were included to illustrate, as far as possible, the vocational context. The diagrams represented the reality of vocational (as opposed to other, non-vocational) classrooms. They conveyed the reality that plastering and painting and decorating workshops can be cold in the winter and too hot in the summer and were often used as thoroughfares to exterior parts of the college in ways that other learning contexts would never be; that the hairdressing teaching contexts re-creates the ambiance that reflects the workplace with music and colour, uniforms and cultural practices. The whole point about setting up an operational kitchen or a hairdressing salon is to provide a learning environment 'as if' it was a real vocational environment.

Recordings were made of all the feedback discussions observed. These recordings provided rich narratives to enhance the observations and, to supplement observations, semi-structured interviews focussed on affective aspects of vocational teachers' experiences. Framed by a CHAT activity system heuristic, the purpose of using interviews in teacher observation research was threefold. Firstly, interviews were used to place the activity subjects culturally and historically. Biographies of the subjects were therefore gleaned through interviews. Secondly, they were used to generate subjects' accounts of the purpose of the teaching observation; the object of the activity. Thirdly, they offered an opportunity for subjects to discuss practices that had been observed.

Examining how vocational teachers maintain and refresh occupational expertise

The starting point for ethnographic research with vocational teachers in England on developing their vocational expertise was informed by a questionnaire, responded to by 88 FE teachers. From this, respondents were identified to take part in follow-up, in-depth interviews. Seven FE teachers of a range of vocational subject areas were interviewed. Data from these interviews were analysed following a grounded approach that encouraged the emergence of key themes. The importance of employing interviews in exploring teachers' perceptions of their CPD is explained by Foddy, in that interviews enable an exploration of past experiences, beliefs, values and attitudes, in other words, "…subjective variables that cannot be measured directly" (Foddy, 1993, 1).

Emerging from the findings of the initial questionnaire was the centrality of professional associations in enabling teachers to refresh and develop their vocational expertise. Sixty percent of respondents to the questionnaire were active in a professional association. Thus, the observational part of the research on vocational teachers' CPD explored the ways in which these professional associations were utilized. The aim was to trace the trajectories and map networks of teacher's engagement with activities. In keeping with ANT, the individual actor, the teacher, was followed wherever they led so that:

Instead of imposing a pre-established grid of analysis upon these, the observer

follows the actors in order to identify the manner in which these define and

associate the different elements by which they build and explain their world, whether it be social or natural. (Callon, 1986, 4)

The methods adopted had to enable the research and researcher to follow these teachers as they crossed organizational boundaries in the pursuit of their professional development. Two professional associations provided the initial focus for the research: The Association of Hairdressers and Therapists (AHT) and the Association of Painting Craft Teachers (APCT) and the chairs of both were interviewed. As an ex hairdressing teacher and member of AHT, Broad (2013) decided that following the AHT through participant observation would prove much more fruitful. She could enter relatively easily into their world as it was a world to which she once belonged.

Broads relative familiarity allowed access to the AHT's community of practice as a participant observer. In planning the observer role, the work of Gold (1958) was drawn on, who offers a continuum of research roles and two of interest here are 'participant-as-observer', where the observer is part of the group under study, and 'observer-as-participant', where the researcher has less involvement in the social setting under study. Participant-as-observer role was employed at events where the observer could take an active part, such as student competitions. The second of Gold's categories of observer-as-participant was used when attending meetings. According to Robson (2002), when using this approach, the observer takes no part in the activity, but the status of the observer is known to the group. It was also imperative to follow the advice of other researchers adopting this approach and to, "…focus more on observation than participation." (Halpern, 2011, 4). The activities observed were, attendance at AHT executive committee meetings, regional student hairdressing competitions and the annual AHT weekend seminar/conference. At the competitions, as the observer was one of the very few who had no responsibility for a group of students, it afforded the opportunity to take on general roles such as registering students for the competition and collating judging scores, checking for accuracy of data. At one competition, the observer was able to utilize prior experience as a hairdressing teacher and acted as a judge, working closely alongside two other judges. Due to the nature of participant observation, field notes could not be taken in real time. In order to develop comprehensive field notes after the events took place, a specific recording device was developed by combining Spradley's (1980) observation checklist with that of LeCompte and Preissle (1993).

As part of the immersive process of participant observation and to complement and triangulate the observational data, informal group and individual interviews were conducted. There was no pre-determined interview schedule, rather these interviews took the form of professional discussions that focussed on observed activity. These were recorded and transcribed in the same way as the earlier interviews with vocational teachers.

Our account of our respective methodological approaches has been provided to emphasise that the approaches we took reflected our conceptions of vocational practice. Observation as a method of both capturing vocational FE teachers' practice, whether in the process of developing pedagogic expertise or in refreshing vocational knowledge and expertise, provided a means by which practice can be made visible. For both research studies, it proved central. Whether acting as an unobtrusive or participant observer, both afforded opportunities to make practice visible from 'the ground up' as teachers can be seen in both developing vocational knowledge in practice (it is dynamic) and in talking through what they do and why they do it. Complementing observations with in-depth interviews allowed teachers' understandings of processes to emerge and perceptions be captured, adding to the richness of the ethnographic data generated. We accept that our professional histories meant that we could both access and engage *in situ* with vocational teachers – whether in vocational classrooms or engaging with professional association activities. Following Labaree (2002, 104) we can be seen to have benefitted from 'insiderness' in the most positive of ways through:

> *…the value of shared experiences; the value of greater access; the value of cultural interpretation and the value of deeper understanding and clarity of thought for the researcher.*

In this section, we have explained the methodologies employed to enable us to capture the richness and complexity of vocational practice. Whilst these approaches differed in the conceptual approach adopted, the methods used were similar and allowed us to view vocational expertise as it developed in and through particular practices and in particular and unique settings and contexts.

In the next two sections, we present key findings from our respective studies in relation to how vocational teachers develop first their pedagogic practice and second, their vocational expertise.

Developing expertise through teaching observations

Teaching observations have long been seen as a means to evaluate teachers' practice. However, the discourse concerning the use and value of teaching observations in the development of teachers' pedagogy in FE has been dominated by a complex web of increased regulation, centralisation, and funding-driven initiatives designed to ensure more accountability (see, for example, Avis *et al.*, 2011; Lucas and Nasta, 2010; Coffield *et al.*, 2008). In this context, conducting observations of teachers' practice became, as O'Leary (2013, 699) has highlighted, "…a vital tool in the performance management of standards in teaching and learning." And, perhaps unsurprisingly, these observations of practice have been seen to add little value to the FE teachers' developing pedagogy (Maxwell, 2014; Orr and Simmons, 2010). Whilst relatively marginalised by the research community, teaching observations conducted as part of ITT for FE staff have generally been highly valued by teachers who see feedback and discussion opportunities as particularly helpful (Orr and Simmons, 2010; Harkin, Clow and Hillier, 2003). Teaching observations in FE have, therefore, largely been modelled dualistically, with ITT observations construed as being part of a developmental discourse.

Despite this developmental positioning, few studies have captured either the nature of the development; challenged the rather 'taken-for-granted' nature of the phenomenon of observation or focussed specifically on vocational teachers' experiences of observation as they crossed boundaries from their respective vocational fields into teaching (Lahiff, 2017). The research on which this chapter draws centred on vocational teachers' experiences of ITT observations by assessing their use and value in the development of emerging practice. Two interacting types of development were evident: the development of pedagogic expertise, which was seen as the outcome of observations conducted with non-vocational observers, and the development of pedagogic expertise for vocational practice (Lahiff 2015; Lahiff, 2014). In this chapter, the focus will be on the latter.

Vocational Expertise: the building block for pedagogic development

Vocational teachers from catering; health and social care; specialist make-up (hairdressing for performing arts); plastering and painting and decorating made up the research sample. They were supported by mentor-observers who shared occupational areas. A common feature of the profile of the vocational teachers and their mentors was the length of time they had spent in their respective vocational setting and prior to entering teaching averaged for both, more than 15 years.

The centrality of vocational expertise is captured by Alan, the specialist make-up vocational teacher, who explained that his part-time teaching hours in a Performing Arts department involved teaching across specialist make-up for theatre courses, where his vocational expertise across hairdressing, styling and in theatre was particularly valued:

> *In Specialist Make-up…it's not all the hair cutting, it's not the colouring, it's literally big hair, cage work, fashion hair,…get it out, get it on, which for me is [brilliant]. I've always been interested in theatre, I like shows, I like going to the theatre, I like looking into the historical context of performances…I've done some work at the ENO [English National Opera]…doing wig changes and stuff like that…so I know what the work is like.*

Vocational teachers' knowledge of vocational practice and experience in the occupational area was referenced frequently by their vocational mentor-observers as absolutely vital, not only in relation to the vocational students' learning, but also in structuring the expectations of vocational learning environment. These expectations were integrated into vocational teachers' practice and were commented upon by vocational mentors as part and parcel of learning about the real world. This was the case irrespective of whether they were expressed in real-life stories told to students about kitchen codes of behaviour or the problems of preparing hair on-set, or whether classroom practice modelled and/or challenged the banter of the construction site.

As outlined in the introduction to this chapter, entry into teaching is often happenstance – something conveyed richly by Alan, who had been working as a technician in the department:

My boss called me into the office and said "we're really stuck for a teacher in hairdressing tonight, do you want to do some teaching?" I was thinking "shit" I'd never done any teaching before in my life, but I said "yeah alright then, I'll give it a go"! …fortunately, it was the first year's practical lesson…And then it just went on from there. And then I got more and more teaching hours

Alan's comfort in accepting a teaching role reflected the vocational teachers' familiarity with the practical setting – the 'mock' vocational environments replicated in FE colleges. However, the vocational teachers in this study felt particularly uneasy when faced with a non-practical environment and/or when expected to teach vocational theory separately from the practice setting. Simona, the painting and decorating teacher, expresses this in the following way:

In the beginning, I didn't know what to do in a classroom! I had mixed feelings about doing this. Knowing how to engage your learners and motivate in a theory class in difficult – especially in your first year. In practical, it's not a problem. Everyone expects to be doing practical and you can get them engaged, but it comes as a surprise when they have to do theory. The practical comes easy because you are so used to it - to structure it, how you are going to start it. It comes naturally….you do it every day!

In this context, we can see how in the absence of familiar artefacts, tools of the trade and vocational setting, the vocational learning environment is at once stripped bare. It no longer resembles the wider vocational contexts; aspects of vocational teachers' knowledge and expertise is lost and opportunities for vocational teachers to draw upon the visceral in their work with students are at once removed.

Given the above, vocational teachers new to FE were generally observed teaching by vocational mentors in the practical setting in the first instance. The strength of the focus on the development of pedagogy, as opposed to vocational knowledge and expertise, is stated clearly by Vince, the plasterer's vocational mentor. When asked whether he would comment on a vocational teachers' vocational expertise in an observation, his answer was equivocal.

I would never actually get involved with how he's doing the job… because I'm on the same level as him…. He's a tradesman already... No, no, that would be too

arrogant of me and I would never overstep that border. [I might say] "that's a funny way of doing it, I've never actually thought about that"...No, I wouldn't find myself that arrogant that I'd actually tell him his job. [...] At the end of the day, as long as you come to the same quality of work, [...] it's within a tolerance, then you're laughing.

Learning through the observation process: the feedback discussion

In terms of the expectation of the observations, the catering teacher explained, using a cooking analogy, the expectations he had:

...when I'm doing an observation [of students' practice in the kitchen]...if they were doing an assessment and they presented a dish, I would taste it for seasoning, taste it for flavour, taste it for texture, and then I would tell them if it was too salty, or not enough seasoning. I would tell them if it was still tough or if it was not cooked, and so forth. And then I would turn and suggest to them "next time maybe you should get this on first" or whatever.

Vocational teachers outlined the expectations they had regarding feedback. Generally, they welcomed a balance between guidance from mentors on the ways in which specific teaching strategies might be introduced or developed based on the observed practice, and opportunities to discuss broader issues related to their practice. As will be seen, below, with vocational mentors as observers, feedback took on a discursive quality, clearly framed by knowledge of vocational and occupational practice.

When asked to summarise their learning from observations, all the vocational teachers were able to explain reflect on their progression in the time involved on ITT courses. For instance, Clive, the plasterer, explains how following observation feedback from his mentor, he re-considered the ways in which he structured demonstrations of vocational practice:

...So what I've learnt to do is break down objects into bite size pieces, "and this is how you handle the trowel, and this is how you put it on the wall" so you're actually building, like small building blocks. Because I can remember when I first,

you know, took [students] through plasterboard work [I just said]…"oh and you pick up a plasterboard", but then you realise that the plasterboard has to be placed right. So literally breaking everything down, almost like a script. I found myself going home and writing every single stage of what we're doing, because you just don't realise that you just do all this stuff.'

Maria, the social and health care teacher, identifies her learning from observation feedback in relation to a range of pedagogical issues:

…[I'm]…learning [many] things: how to layout the class; body language; not to have too high expectations; not to spoon feed students…to challenge them…

In all the case studies, vocational teachers relished the opportunity to both discuss the observed teaching and consider how they could put ideas generated into practice. For them, the feedback discussion provided the context for development of this pedagogic expertise. They did not, however, expect discussions to be too 'cosy', as one vocational teacher remarked:

[the observer] is not going to fluff around it because she likes you, do you know what I mean?...she's going to tell you how it is. And you want to do it for her because she's passionate about what she does. And my feedback was, well, to get that feedback from [observer] in a year and a half is amazing.

Feedback discussions across most of the case studies reflected the specific challenges of planning teaching and learning in vocational contexts. This meant that, in the catering case study, strategies were shared with the vocational teacher to help students develop time-bound vocational practice. In preparation for the post-observation feedback discussion Rachel, the catering vocational mentor, emphasised the importance of time-efficient practice in catering and why this aspect framed her discussions.

When you go into industry, we haven't got half an hour to go around and collect our ingredients, the chef would be cursing, he'd be swearing at you and he'd go "there's the door, goodbye!".

In the feedback discussion, she then shared the strategies she used in practice:

You need a time clock, you need a time clock ticking away. "So you've got 15 minutes, here's the clock", this is how I teach them when I'm teaching it, when they just begin. I put it on the television [in the restaurant] and say "You've got 20 minutes to do this task, at the 20 minutes we stop".

In the feedback discussion, reflections on the ways in which the vocational teacher has developed sequencing in a skills demonstration enabled Rachel to praise the development of processes from previous observations:

So that's good how [you] are doing that [demonstration] in small chunks, so that [you] are basically not asking too much of them, and then they can remember and [you] can go round and check their progress if they're unsure, you know, about cutting the meat "let's reinforce it, let me show you again", and then call them back once more.

The feedback discussion therefore offered opportunities not only to share strategies for the vocational context, but also to develop solutions to real challenges as experienced by vocational teachers. Each observation of practice presented different and often unanticipated opportunities to develop pedagogy around varied aspects of practice. Vocational teachers, in the process of discussing observed practice with their mentor-observers can be seen to recontextualize (Guile, 2010) their pedagogic knowledge and understanding. The discussion opportunity can therefore be seen to illustrate the interrelationship of social practice and individual capacity in the development of expertise (Winch, 2010; Felstead *et al.*, 2005; Engeström, 2004; Billett, 2001). As argued elsewhere, (Lahiff, 2017; Lahiff 2015) the feedback discussion acted as a verbal and developmental space where vocational teachers and observers use and develop the language of pedagogy. Vocational teachers and their respective observers were, to a greater or lesser extent, actively engaged in developing pedagogic expertise for vocational practice (Lahiff, 2017; Lahiff, 2014).

Short summary?

Developing expertise through CPD

Following on from the previous section, here we move to examining the professional development of established teachers. A significant concern for these teachers is that once removed from where vocational knowledge is developed and shared in and through practice, the development of their own expertise can stall for three reasons. Firstly, vocational knowledge can be seen to be 'in motion' (Broad 2016). It is temporal in nature and requires constant movement and circulation. Teachers, as they move away from their occupation, are no longer part of this network of relations. Secondly, each teacher is uniquely situated in terms of their current levels of expertise. This rests on how long they have been away from their industry or occupation and what opportunities have been afforded since becoming a teacher. Thirdly, teachers in this study explained that the colleges where they were employed place little importance in them maintaining their occupational expertise, as illustrated here by the early years teacher:

> I don't think they are in the slightest bit interested once they have employed you. So they employ you for your subject expertise, but after that [...]

The construction teacher shed light on why this may be and stated:

> But, it's not important to them, other things are and it's expensive. Like how would you go about maintaining subject specialism for carpenters and joiners? How would you go about facilitating that? You would have to get somebody in to show them a specific development and that's time, materials, money, space, all the rest of it you know and it starts adding up.

Therefore, each teacher will, by necessity, follow their own trajectory and often follow more than one pathway in pursuit of the development of vocational expertise.

Teacher agency: doing it for themselves

Teachers act heterogeneously and each follow a unique path of CPD, finding personal and professional value for themselves. We can also begin to see that these paths are multiplicitous. For example, the construction teacher who found value in reading specialist materials also described how he spends much of his free time going to museums in London

and explained that, "For me it's not business, its pleasure." He described his visits to the Victoria and Albert Museum in London to see exhibitions on different furniture styles through history and said that the experiences are, "incredible". A smaller, but equally fascinating museum for this teacher was the Geffrye Museum in East London that exhibits rooms of English interiors from different eras.

The experiences of the carpentry teacher also sheds light on the temporal nature of vocational knowledge and subsequent issues for the development of expertise. For this teacher, much of his development centred on linking the historic and traditional with current and emergent trends. He had attended a course on making a Windsor Chair and was extremely knowledgeable about the history of this chair, its place in English furniture making and its connections back to the great furniture makers of the past, such as Chippendale. This experience was explained in detail:

> *I am really into my subject, I love it. I love chairs as well as it happens, I think they are fascinating things, they are you know, they hold up the body but you know, it's almost like a negative shape of the human body if you look at a chair. But there are so many variations and types, I mean the variety of chairs out there are just incredible...England has a great history and culture of furniture making, like this particular chair and it's the Windsor chair and the development of that is just fascinating you know, it's not held together with any glue, there's steam bending involved, bending of the wood, shaping of the solid components and it takes a lot of knowledge to prepare this particular chair. It comes originally from the Windsor area, particularly around High Wycombe because they had huge forests of beech trees, pretty much all decimated now.*

Developing expertise through sharing with others

Teachers seek out ways of engaging with others to share practice and develop their vocational expertise through this practice of sharing. The first examples show how teachers share vocational knowledge and expertise with teaching colleagues within their own work contexts.

A hairdressing teacher explained how she and her colleagues use college facilities at the end of the teaching day to practise with new techniques and products. One particular example used a cascade model of learning based on one teacher's attendance at a product training course, which was described as:

> *For example on Friday when we finished, we finished at two o'clock and we did CPD training on a new treatment that has just come out. One of the other teachers had gone on the course and showed us what she had learnt. We tried it on each other, we are thinking of using it at the college for clients.*

A further example of learning mediated through and with others was of teachers learning alongside students. Events are organized by teachers for their students whereby outside speakers such as product or equipment manufacturers provide training on products and tools.

> *We get outside agencies in, […] we had a demonstration from Babyliss [electrical hairdressing tool manufacturer], we have Wella [hairdressing product manufacturer] coming in to do product knowledge talks. Erm, we have just switched over to L'Oreal [hairdressing product manufacturer] products, so we had L'Oreal coming in.*

When one of these events is planned, the rest of the hairdressing teaching team is informed and they can also attend.

> *if something comes up, we invite the other members of staff. If it's for a day when we are all not teaching, then, it, everybody is invited, but if it is a day when everybody is teaching, then it's more difficult. […] Quite often I organize things and it's for my lecture but the other teachers come in.*

Learning mediated through colleagues was also described by the carpentry teacher who described how new teachers often share fresh and current occupational expertise with more established teachers. This collaborative process is a direct contrast to Lave and Wenger's (1991), initially simplistic notions of the journey from novice to expert, from peripheral to full participation. This chimes with Fuller *et al's* (2005) research in which they identified the limitations of Lave and Wenger's concept of the 'novice' or 'newcomer'. In the two examples

provided by the carpentry teacher, a more complex multi-directional movement enables occupational knowledge to circulate through novice teachers and appears to be a relatively common method of development to vocational teachers.

In the first example, he employed a technique learnt whilst working as a cabinet maker which enabled him to take technical short cuts with veneer work. He explained how this was shared with colleagues:

> So it just happened one day that I was actually making draws [with students] and he [another teacher] was coming through the workshop and he was 'What are you doing?' I said 'this is a good time, we are making draws'. […] But flipped it over, put the glue in and with the sellotape, all the sides just snapped together and to cut a long story short, it makes a complex process incredibly easy. One person can do it and there's no big usage of cramps and he looked at it and said 'that's pretty good'.

He also relayed how he shared his experience of computer design, learnt in industry with colleagues:

> I was telling [named two colleagues] about that particular class and what we were doing, which actually moved on from doing basic drawings to a window. And they were quite curious about it so they came up into the class and er, watched what I was doing and that's CPD. And as we spoke about it later, that's probably the best CPD we had done in a long time.

The second examples below show how teachers cross boundaries through professional associations and highlight both the benefits these afford and the importance placed on these by teachers. Professional associations enable teachers to learn from each other the emerging trends within the occupation. Vocations and occupations and the knowledge used within these are in constant flux, changing and developing with procedures and techniques improving and developing. One AHT hairdressing teacher explained the high levels of currency for hairdressing and said:

> Our industry is based upon the lines of fashion and there are always changes, and there are the new awards that they are bringing out. New treatments. They might

not be established, but as they become more widespread through the industry
they become more established.

The professional associations enable teachers to network with other teachers and the importance of being able to cross organizational boundaries to do so was explained by one AHT teacher as:

You network with all the different colleges up and down the country and you get
to know so many people.

The central significance of the process of sharing in collaborative networks that met in particular contexts was a common theme emerging as to the benefits of belonging to a professional association One hairdressing teacher explained these benefits and processes and he said:

You can talk to people and when you talk to them you find out that they have the
same problems as you have.

Another hairdressing teacher explained this as:

Just talking to people you pick up ideas and often some of the things that they
have changed, you think, I could go along with this.

And yet another comment was:

The more people you are, that are talking to each other, you can advise and share
with each other.

Codifying and transporting vocational knowledge and expertise

Professional associations afford teachers a unique opportunity to both network with others and to capture vocational knowledge and expertise for transportation back to their classrooms and workshops. As discussed earlier, the nature of vocational knowledge means that it resists codification (Livingston and Guile 2012) and thus presents significant challenges for teachers in capturing current trends and approaches to use with students in classroom and workshop settings. For many teachers, an important aspect of developing their

occupational expertise was to capture action in various ways. This then enabled them to transport new vocational knowledge from contexts where it was developed and was used in two ways. Firstly, to act as an aide memoire and future reference, and secondly to be used with students in teaching contexts.

An example of the use of photographs can be seen in the practices of hairdressing teachers who organize student competitions both in their own college and to facilitate their students competing against students from other colleges and where much of the data was gathered. These competitions afford teachers with ways of keeping up-to-date with current trends. This was explained by one hairdressing teacher who said:

> *You see the changes and the styles changing and the fashions and the colour trends coming through.*

He explained the use of a camera to capture these latest trends in the occupation that were being produced by teachers and their students from other colleges. Another teacher described watching a particular competition where one student used the very traditional technique of 'fingerwaving'. This was described as a well-known hairdressing procedure, introduced in the 1920s, and part of the current hairdressing curriculum. It is however, a very difficult technique to master. The student competitor used special clamps and tools to enable her to carry out the procedure. The teacher commented that:

> *I've not seen that tool used in that way before. So I've taken some photographs and I'm going to go and get that tool when I get back.*

Vocational expertise and knowledge is both tacit (Eraut *et al.*, 2000) and situated within context (Fox, 2000). Hence, these photographs become an easy way of recording action in the here and now, they become shorthand accounts of action, captured and made concrete. They thus allow for specialized techniques to be transported to other contexts.

Moving away from the hairdressing teachers, photographs are also used by vocational teachers to capture knowledge direct from the occupation and was identified by the applied sciences teacher who explained how he used photographs from his practice to enhance student learning:

Oh my patients are always cropping up in my lectures. The pop up all over...I take an awful lot of pictures...when they have got interesting problems and bits and pieces

This section has presented findings from the research project on vocational teachers' CPD that demonstrate the myriad ways in which they work with others to access vocational knowledge in order to refresh and maintain their occupational expertise. The following section draws together the findings from both research projects and presents emerging themes in the development of vocational teachers' expertise.

Discussion

By drawing on our respective research projects, this chapter set out to explore the ways in which vocational teachers develop their expertise. This encompasses vocational practitioners as they transition to becoming teachers and develop their pedagogic expertise. It also includes how they use their CPD activities to remain in touch with and current in their vocational specialist area.

Our studies have confirmed that, through the use of both in-depth interviews, ethnographic observation and by 'following the teacher', we have been able to make visible the practices of vocational teachers as they develop their pedagogic and vocational expertise. This is in full recognition of the argument that much vocational knowledge is tacit and therefore problematic to view. In this section, we draw together some common elements that connect our empirical research. Our argument is that they are important factors in both the development of vocational teachers' expertise and in capturing the processes involved. The elements are: i) the significance of artefacts; ii) the centrality of tacit and visceral; iii) the agency of vocational teachers; iv) the mediating role of others in developing expertise.

i) Artefacts

We have provided an account of the methodological approaches adopted in our respective studies and outlined the rationale for the analytic lens offered by CHAT and ANT respectively.

In both studies, artefacts and other network effects were central to understanding the ways in which vocational teachers develop expertise. In the teaching observation activity, artefacts were construed as part of the activity heuristic's conceptual toolbox. Artefacts in this analysis were not be considered in relation to their physical form or their content. Rather, how these artefacts were seen to operate in the activity was the subject of consideration. As Ellis, Edwards and Smagorinsky, (2010, 18) remind us:

...tool-use reveals something about the cultures within which the tools have developed as well as the thinking of those who work with them and, further, highlights the relationship between these two, social and historical processes.

Artefacts therefore have been understood in terms of their mediating role in moving the activity towards the object or goal. In CHAT terms, the feedback discussion is positioned as artefact. In the case study illustrates provided here we have shown how the artefact mediates learning and moves the activity towards the object of activity.

However, artefacts in the vocational classroom have significance beyond this modelling. Vocational teachers, metaphorically, feel at home because of these artefacts; they were seen to position the vocational teachers. This is because the artefacts in question are the ovens, knives and uniforms; the hairnets, hairdryers and block heads and the trowels and paintbrushes that represent the workplace. They are at once tools of the trade and artefacts in an activity. As tools of the trade they 'carry over' their practical and symbolic meaning.

For vocational teachers using CPD activities to refresh and update their occupational vocational expertise, artefacts were also shown to be central to the process in many instances. They use artefacts, normally in pictorial form, to codify and transport vocational knowledge and expertise from the site where it is captured to classrooms and workshops to use with students. Within ANT, these can be understood as inscription devices, a distinct form of actor within a performative network. The concept of inscription devices was developed by Latour (Latour, 1987, 68), whose initial definition was, "...a visual display of any sort of scientific text..." For Latour, it is a semiotic representation of laboratory work, the effort and resources mobilised to make scientific facts and serves as a junction between two worlds by presenting to one a visual representation of the other. In an example given by Latour (1987), a particular laboratory instrument, a physiograph, produces a raw image, a

representation of some scientific findings. This raw image has been, in ANT terminology, enacted into being within the laboratory. It then becomes a figure within a scientific journal and through this journey it has become an inscription device, a shorthand diagrammatic account of laboratory work, which can connect to other worlds and spaces. It has become a looking glass, enabling the reader of a scientific journal to see into the laboratory.

For the vocational teachers in this study, artefacts also serve as a shorthand representation of one world to another. They enable teachers to capture vocational knowledge as it is developed in practice, make shorthand versions of this knowledge and move it to other contexts, recontextualized for other usage, either as their personal aid memoire or as teaching aids.

ii) The tacit and the visceral.

Our research has confirmed the importance of the visual in accessing and capturing vocational knowledge and expertise through the use of photographs. Additionally, we stress the importance of all the senses in vocational contexts and, significantly, in the development of expertise for vocational teachers. With respect to the development of pedagogic expertise, the sounds and smells of the workplace can be seen to shape the experience of practice, including the verbal encounters and physical relationships with learners. In their practical contexts, vocational teachers are helping learners to get to know the feel of, smell and/or sound of artefacts so that they may best develop their own vocational practice in the workplace. However, as we have shown with respect to practice in some case study contexts, theory and practice is separated. We argue that this is a spurious separation.

With regard to teachers' CPD, we have shown that it is the tacit and visceral nature of vocational knowledge and expertise that ensure its complexity and heterogeneity. Teachers follow their own pathways and engage with a variety of networks in the pursuit of new vocational knowledge. In addition, the consequence of its very nature is the subsequent barriers that teachers face in developing their occupational expertise. The ANT analysis here shows its development as a network effect, rather than a codified product. Drawing on the work of Nespor (1994), Fenwick and Edwards explain learning as "…ways of being, ways of acting, ways of feeling, ways of interacting, ways of representing, as well as ways of knowing."

(Fenwick and Edwards, 2013, 52), that they argue emerge through the materializing networks. Thus, conceptualized as effects that fold out of networks, it becomes clear why not all forms of knowledge can be easily seen, identified and codified.

iii) Agency of vocational teachers

In both research contexts, we found that the agentic actions of vocational teachers and those with whom they shared experiences, whether in the teaching observation activity or in networked web of relations that form CPD opportunities, were key aspects in the development of expertise. In vocational teachers' observations, the CHAT framework enabled subjects in the teaching observation activity systems to be seen as taking action to move the activity towards the object of activity; to use and/or adapt artefacts in the activity and negotiate the rules that underpin the activity. Equally, Broad's work demonstrated that teachers act heterogeneously in that each will follow their own particular path in the development of their vocational expertise. In addition, due to the complexity of vocational knowledge and expertise, they follow paths that are multiplicitous, developing their expertise through varying mechanisms, carried out concurrently. These paths are chosen individually by the teacher so as to provide the most fruitful experiences that afford opportunity to develop the nuanced aspects of practice they have self-identified.

To fully appreciate the significance of the agentic actions of vocational teachers and their colleagues the broader structural issues of their employment in FE colleges need to be appreciated. We have referred to the complex web of increased regulation and control effecting FE in the last 10 years[2]. Significant was the rise in targets and the performative (Ball, 2003) approaches adopted in approaches to the management of teaching and teachers in FE. This is mirrored in the decidedly uncomplex ways in which teachers' CPD was conceptualized in the period between 2007 and 2012. The identifiable impact of the legislative requirements in this period, whereby CPD hours had to be counted and recorded led to the development of systems that included "...master spreadsheet[s]...databases...and 'frameworks'." (Orr, 2009, 486). The impact of all these factors meant that FE teachers faced significant barriers

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[2] One consequence of this is the casualization of the FE teaching workforce (DfES, 2002; Foster, 2005)

to engaging with activities to develop occupational expertise that were mainly due to access to funding and to time (Broad, 2013).

iv) Mediation

In both of our studies, expertise was seen to be developed in practice with others. Given our conceptualisation of vocational expertise as distributed and social, rather than solely residing in the head of individuals, this in itself is not unexpected. However, our contribution has been to make visible the form(s) that mediation takes and, while the form(s) differ, the significance in the development of expertise is confirmed. With respect to teaching observations, in making visible the post-observation feedback discussion and identifying it as a mediated learning process, we have shown how the post-observation feedback discussion provided the verbal space for the development of pedagogic expertise for vocational practice. The development was mediated by mentors, who engaged in discussions of practice and guided vocational teachers' pedagogic development through the vocational lens.

With CPD activities, the concept of mediated practice was shown as emerging from action and actors within networks. The significant aspect of this, as shown by the radical symmetry approach of ANT is that these networks were made up of both human and non-human actors and through taking account of the actions and interplay of all actors within a network, the ways in which vocational knowledge is developed and shared is illuminated. ANT has allowed us to see that professional vocational knowledge is developed through a web of relations and interactions that are not context free and are determined by mediators working within the network to exert power onto teachers as actors within this wide web of relations. The complexity and heterogeneity within this means that teachers will each follow a different trajectory to others who share the original occupation as they attempt to maintain their occupational expertise.

The ways in which these things come together ensure strong network connections which in turn enable a high level of circulation. The importance of this can be explained through ANT in that the nature of actor-networks is that connections between actors, to ensure circulation and translation, are always being made and remade. A network will only remain stable if all actors, both human and non-human remain faithful to that network (Whittle and Spicer,

2008). It is through continually negotiating and re-negotiating links between the actors, through a high level of engagement through these activities, which enables a network to become stable.

This section has drawn together the common themes emerging from our respective research projects and demonstrate the complexity of the development of vocational expertise. It shows that to understand it requires certain conceptual tools and frameworks which in turn inform the specific research approaches necessary. In order to understand the complexity, we outline ways of approaching and engaging with participants as they work in concrete and experiential ways to develop their expertise.

Concluding remarks

By drawing on our research with FE vocational teachers, this chapter has shed light on the ways in which vocational teachers' expertise is developed in and through practice. We began by conceptualising vocational expertise and have argued that identifying and capturing its complexity presents challenges for the researcher. However, with judicious and careful selection of approaches, we have shown how, for example, the tacit and day to day development of vocational practice can be made visible. We have argued, therefore, that the use of observations of vocational teachers *in situ* and engaging in discussions provided opportunities to capture the various ways in which vocational teachers develop their pedagogic and vocational expertise.

We have argued that in researching teachers' developing practice, the role and professional expertise of the researcher has been central. In both our cases we were familiar with the practices we set out to research. This enabled not only access but also understanding of the respective research sites and credibility with the participants. We argue that this allowed for more detailed and rich research data to be revealed and captured by us.

The chapter also set out to inform ways of thinking in relation to supporting the development of vocational teachers' expertise. From our research into the development of pedagogic expertise and vocational knowledge, we argue that it is incumbent on policy makers and FE college managers to appreciate the complexity that underpins the development of the dual professional. Rather than restricting the time taken to develop pedagogic expertise with

others and/or pre-defining CPD for vocational teachers, mechanisms that enable vocational teachers to share and develop practice with others will afford greater opportunities and, ultimately, ensure a more meaningful vocational learning experience for students.

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